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ABSTRACT

This course is designed to help military personnel to attain the rating of optometry specialist in the Air Force. The packet includes both a teacher's plan of instruction and five student study guides/workbooks. The teacher's plan of instruction contains lesson plans, lists of student instructional materials and audiovisual aids, and suggested methods and instructional guidance for the course. Designated Blocks I-V, the five student study guides/workbooks cover the following topics: introduction and basic optics, visual acuity and its correction, assisting the optometrist, vision classification, and clinic management and practicum. The guides contain an introduction, objectives, information, and exercises. Materials are illustrated with line drawings. (KC)

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OPTOMETRY SPECIALIST

SHEPPARD TECHNICAL TRAINING CENTER
SCHOOL OF HEALTH CARE SCIENCES
Department of Biomedical Sciences
Sheppard Air Force Base, Texas

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CE 043 426

POI J3ABR91235 000

(PDS Code PDW)

PLAN OF INSTRUCTION

(Technical Training)

OPTOMETRY SPECIALIST

SHEPPARD TECHNICAL TRAINING CENTER

12 April 1984 - Effective 12 April 1984 with class 840412

ATC FORM 214 (JAN 76) OBSOLETES ATC FORMS 214, MAY 69, 522, NOV 63 AND 523, MAY 71. STANDARD COVERSHEET

LIST OF CURRENT PAGES

This POI consists of 32 current pages issued as follows:

Page No.	Issue
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A	Original
i	Original
1 thru 17	Original
18	Blank
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22	Blank
23 thru 29	Original

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DEPARTMENT OF THE AIR FORCE
School of Health Care Sciences. USAF
Sheppard Air Force Base. Texas 76311

PLAN OF INSTRUCTION J3ABR91235 000
(PDS Code PDW)

FOREWORD

1. PURPOSE. This publication is the plan of instruction (POI) when the pages shown on page A are bound into a single volume. The POI contains the qualitative requirements for course J3ABR91235 000, Optometry Specialist. in terms of criterion objectives for each unit of instruction and shows time. training standard correlation. and support materials and guidance. When separated into units of instruction. it becomes the lesson plan/Part I. This POI was developed according to AFR 50-8, Instructional System Development (ISD), and ATCR 52-6, Curricula Documentation.

2. COURSE DESIGN/DESCRIPTION. The instructional design for this course is Group/Lock Step. This 9 week course trains airmen to perform duties prescribed in AFR 39-1 for Optometry Specialist. AFSC 91235. Training includes basic ocular anatomy and physiology, basic visual physiology, basic optics. use and maintenance of optometric testing equipment. medical ethics. clinic asepsis, and ocular referrals. It prepares the student to (1) perform visual screening tests. (2) assist in examination and treatment of patients. (3) assist in the preparation and fitting of spectacles. (4) assist in the fitting of contact lenses, (5) perform related administrative duties. In addition. military training is provided on end-of-course appointments, predeparture safety briefing, and physical conditioning.

NOTE: Students may use instructional material with no instructor assistance during the performance test unless otherwise stated in the objective. Written progress checks are denoted as work sheets (WS). In addition to the instructional materials listed throughout this POI. the student may use the following dictionaries as his vocabulary needs dictate:

Schapero. et al. Dictionary of Visual Sciences
Dorland's Medical Dictionary

As long as they are available the following texts may also be optionally used to supplement the Student Instructional Materials in units I-1; I-2. I-3. and I-4; II-1; 2; III-1. 2; IV-1; as long as they are available.

Americal Optical Company, Elements of Optics
Bates, Fundamentals for the Optometric Assistant

3. REFERENCES. This plan of instruction is based on Specialty Training Standard 912X5, October 1983. and Course Chart J3ABR91235 000, 12 April 1984.

FOR THE COMMANDER

Peter P. Leuthold

PETER P. LEUTHOLD, Col. USAF, MSC
Chief. Training Operations Division

Supersedes Plan of Instruction J3ABR91235 000, 3 July 1981
OPR: SHCS. USAF/MSDB
DISTRIBUTION: Listed on Page A

PLAN OF INSTRUCTION/LESSON PLAN PART I

NAME OF INSTRUCTOR	COURSE TITLE Optometry Specialist
BLOCK TITLE Introduction and Basic Optics	

1. COURSE CONTENT	2. TIME
1. Welcome and Orientation	4
a. Course welcome, course content, and administration	
b. Course and school policies	
c. Types and uses of instructional materials	
d. Effective study procedures	
e. Fraud, Waste, and Abuse Program	
f. Conservation of training materials, resources, and energy	
g. Community College of the Air Force (CCAF) briefing	
h. Student Critique Program	
i. Safety in the training environment	
j. Testing and grading system	
k. Career ladder progression	
l. Vision care specialist	
m. Introduction to PLATO	

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SUPPORT MATERIALS AND GUIDANCE

Student Instructional Materials
HO J3ABR91235 000-I-11, Optometry Safety
SW J3ABR91235 000-I. Introduction and Basic Optics
SHCS HO/9, Fraud, Waste. and Abuse Prevention and Detection
ATC Programmed Text 52-11. Study Skills
Stein and Slatt. The Ophthalmic Assistant

Audiovisual Aids
FLC 13-202, The Miracle of Vision
Slide Set. Introduction

Training Methods
Lecture/Discussion (4 hrs)

Instructional Guidance
Extend welcome. Complete necessary forms. Emphasize the Air Force's need for quality vision care. Stress AFR 39-10. paragraph 3-81(1).... "members who fail to progress at a normal rate or fail to meet acceptable standards of conduct or duty performance should be discharged." If time permits. allow students to work on PT 52-11. Study Skills. Introduction to PLATO will be given at this time only if class is to use PLATO in Block I.

PLAN OF INSTRUCTION/LESSON PLAN PART I

NAME OF INSTRUCTOR	COURSE TITLE
	Optometry Specialist

BLOCK TITLE
Introduction and Basic Optics

1. COURSE CONTENT	2. TIME
2. Introduction to the Optometry Career Field	10
a. Given WS J3ABR91235 000-I-2a, identify facts pertaining to the USAF Medical Service with 70 percent accuracy. STS: 1d(1), 1d(2), 1d(3) Meas: PC	(2)
b. Given WS J3ABR91235 000-I-2b, identify career ladder progression within the 912X5 career field with 70 percent accuracy. STS: 1a, 1b, 1c(1), 1c(2) Meas: PC	(4)
c. Given WS J3ABR91235 000-I-2c, select statements that relate to general safety with 70 percent accuracy. STS: 4a, 4c Meas: PC	(1)
d. Given WS J3ABR91235 000-I-2d, select the proper placement of listed forms in a medical record with 70 percent accuracy. STS: 17b Meas: PC	(2)
e. Given WS J3ABR91235 000-I-2e, describe the steps necessary for a professional relationship with 70 percent accuracy. STS: 5a, 5b, 5c Meas; PC	(1)

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SUPPORT MATERIALS AND GUIDANCE

Student Instructional Materials

SW J3ABR91235 000-I, Introduction and Basic Optics
WS J3ABR91235 000-I-2a, Mission and Organization
WS J3ABR91235 000-I-2b, Career Ladder Progression
WS J3ABR91235 000-I-2c, General Safety and Accident Reporting
WS J3ABR91235 000-I-2d, Medical Records
WS J3ABR91235 000-I-2e, Professional and Patients' Relationships
AF Form 2100, Series Medical Record
AF Form 718, Color Threshold Test
AF Form 422, Profile Change
DD Form 741, Eye Consultation
DD Form 771, Eyewear Prescription
SF Form 88, Report of Medical Examination
SF Form 513, Consultation Sheet
SF Form 600, Chronological Record of Medical Care
SF Form 519, Chemical Report-Radiographic Report
Lab Forms
Visual Field Forms

Audiovisual Aids

Slide Set, Introduction to the Optometry Career Field

Training Methods

Lecture/Discussion (10 hrs)

Instructional Guidance

Emphasize students' role in the mission of the optometry clinic and evaluate with worksheet I-2a. Explain career ladder progression in the 912X5 career field and evaluate with worksheet I-2b. Discuss safety to lay the ground work for future performance areas and evaluate by completing worksheet I-2c. Emphasize location and importance of past eye examinations and other important forms in the medical record, evaluate with worksheet I-2d. Discuss professional relationships of clinic personnel and patients, evaluate with worksheet I-2e. Chalkboard may be used in lieu of slide set. PLATO IV, Computer Assisted Instruction (CAI) may be used for review or teaching.

PLAN OF INSTRUCTION/LESSON PLAN PART I

NAME OF INSTRUCTOR	COURSE TITLE Optometry Specialist

BLOCK TITLE
Introduction and Basic Optics

1. COURSE CONTENT	2. TIME
3. Geometrical Optics	20
a. Given WS J3ABR91235 000-I-3a, identify principles of geometrical optics with 70 percent accuracy. STS: 9b, 9c, 9d 9e, 9f, 9g Meas: PC	(8)
b. Given WS J3ABR91235 000-I-3b, solve 50 optometric mathematical problems with 70 percent accuracy. STS: 9a Meas: PC	(12)

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SUPPORT MATERIALS AND GUIDANCE

Student Instructional Materials

SW J3ABR91235 000-I, Introduction and Basic Optics
WS J3ABR91235 000-I-3a, Geometrical Optics
WS J3ABR91235 000-I-3b, Optometric Math (A and B series)
Stein and Slatt, The Ophthalmic Assistant
American Optical, Elements of Optics

Audiovisual Aids

Slide Set, Geometrical Optics
Transparency Set, Math Review

Training Equipment

Trial Lens Set
Prism Model

Training Methods

Lecture/Discussion (18 hrs)
Performance (2 hrs)

Instructional Guidance

Explain the principles of geometrical optics and evaluate with worksheet I-3a. Theories of light and light waves should be related to real world phenomena familiar to students. Explain terminology used in reflection and refraction by constructing and labeling light ray diagrams. Worksheet I-3b or PLATO IV test will be used to determine students' ability to perform optometric math problems. Chalkboard or flipchart diagrams may be used in lieu of slide set and transparency set at instructor's discretion. PLATO IV, Computer Assisted Instruction (CAI) may also be used. Written test I-1 will be administered following objective I-3b.

PLAN OF INSTRUCTION/LESSON PLAN PART I

NAME OF INSTRUCTOR	COURSE TITLE
	Optometry Specialist

BLOCK TITLE
Introduction and Basic Optics

1. COURSE CONTENT — 2. TIME

4. Ophthalmic Optics 34

a. Given WS J3ABR91235 000-I-4a, identify characteristics of opthalmic lenses with 70 percent accuracy. STS: 10a(1), 10a(2)(a), 10a(2)(b), 10a(3), 10a(4) Meas: PC (7)

b. Given WS J3ABR91235 000-I-4b, transpose 10 eyewear prescriptions with 80 percent accuracy. STS: 10c Meas: PC (2)

c. Given WS J3ABR91235 000-I-4c, convert 10 multifocal eyewear prescriptions with 80 percent accuracy. STS: 10b Meas: PC (3)

d. Given a lens clock and WS J3ABR91235 000-I-4d, measure the base curves of 12 pairs of spectacles. At least 9 must be to an accuracy of ± 0.25 diopters. STS: 151 Meas: PC (4)

e. Using a lensometer and WS J3ABR91235 000-I-4e, neutralize 20 lenses. At least 17 must be to an accuracy of ± 0.25 diopters. STS: STS: 15h(1) Meas: PC (18)

SUPPORT MATERIALS AND GUIDANCE

Student Instructinal Materials
SW J3ABR91235 000-I, Introduction and Basic Optics
WS J3ABR91235 000-I-4a, Refractive Qualities
WS J3ABR91235 000-I-4b, Transposition (A and B series)
WS J3ABR91235 000-I-4c, Multifocal to Near or Intermediate Rx (A and B series)
WS J3ABR91235 000-I-4d, Base Curves
WS J3ABR91235 000-I-4e. Lens Neutralization
Stein and Slatt, *The Ophthalmic Assistant*

Audiovisual Aids
Slide Set, Geometrical Optics
Video Tape. For Soldiers to See
Video Tape, Lensometry

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Training Equipment
Trial Lens Set
Plano Cylinder Model
Plus Sphere Model
Minus Sphere Model
Lens Clock
Lenosometer
Projection Lensometer
Indexed Spectacle Lenses

Training Methods
Lecture/Discussion (14 hrs)
Demonstration (3 hrs)
Performance (17 hrs)

Multiple Instructor Requirements
4d, Equipment, Safety, Supervision (3 instructors for 4 hrs)
4e, Equipment, Safety, Supervision (2 instructors for 2 hrs)
4e, Equipment, Safety, Supervision (3 instructors for 12 hrs)

Instructional Guidance
Identify characteristics of ophthalmic lenses by completing worksheet I-4a. Stress mathematical transposition as a daily clinic task and ensure student proficiency by using worksheet I-4b. Explain conversion of multifocal Rxs and evaluate with worksheet I-4c. Practical use of the lens clock to measure base curves will be evaluated with worksheet I-4d. Demonstrate usage of the lensometer to neutralize lenses. Students should be led through practice trays until proficient enough to begin progress check. Safety and instrument maintenance will be emphasized. Use worksheet I-4e to evaluate lensometry. Use of chalkboard or flipchart diagrams may be used in lieu of slide set at instructor discretion. PLATO IV may be used for review or teaching. Written test I-2 will be administered following objective I-4e.

5. Written Test and Critique	4
a. Written Test and Critique I-1	(2)
b. Written Test and Critique I-2	(2)
6. Military Training	4
a. Physical conditioning Day 3	(2)
b. Physical conditioning Day 8	(2)

PLAN OF INSTRUCTION/LESSON PLAN PART I

NAME OF INSTRUCTOR	COURSE TITLE
	Optometry Specialist

BLOCK TITLE
Visual Acuity and Its Correction

1. COURSE CONTENT	2. TIME
1. Ophthalmic Lens Procurement and Verification	74
a. Given an instructor selected patient and WS J3ABR91235 000-II-1a, perform frame selection with no more than two instructor assists. STS: 15a, 15c(1), 15c(2), 15c(4) Meas: PC	(14)
b. Given WS J3ABR91235 000-II-1b, identify facts concerning lenses procured from military laboratories with 70 percent accuracy. STS: 10d, 15b, 15g Meas: PC	(2)
c. Given AFR 167-3 and necessary materials, complete spectacle order forms, 17 of 20 must be correct. STS: 15c(3), 15e, 15f 15k Meas: PC	(24)
d. Given ANSI Z80.1 Standards, and 12 pairs of spectacles with their corresponding DD Form 771s, verify that the spectacles meet the standards with no more than two instructor assists per box. STS: 15h(2) Meas: PC	(6)
e. Given an instructor selected patient, two cellulose acetate frames, aircrew frame, and the necessary materials, adjust each frame to fit the patient with no more than one instructor assist per frame. STS: 15j Meas: PC	(6)
f. Given an aircrew frame, an S-10 frame, and the necessary materials, perform minor repair functions with no more than one instructor assist per frame. STS: 4b 15i(1), 15i(2), 15i(3), 15i(4) Meas: PC	(6)
g. Given the necessary materials, duplicate 18 pairs of spectacles with at least 15 within ANSI standards. STS: 15h(3) Meas: PC	(16)

SUPPORT MATERIALS AND GUIDANCE

Student Instructional Materials
SW J3ABR91235 000-II, Visual Acuity and Its Correction
WS J3ABR91235 000-II-1a, Frame Selection
WS J3ABR91235 000-II-1b, Lens Availability
WS J3ABR91235 000-II-1d, Verification
SF Form 600, Chronological Record of Medical Care
DD Form 771, Eyewear Prescription
Stein and Slatt, The Ophthalmic Assistant
AFR 167-3

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Audiovisual Aids
Slide Set, Ophthalmic Lens Procurement and Verification
Video Tape, The Lensometer, Final Inspection
Mock-Up, DD Form 771, Eyewear Prescription

Training Equipment
Military spectacle frame parts, 1 set
Indexed spectacles
Spectacle frame fitting set
Optician's tools
PD rule
Frame warmer
Lensometer
Projection lensometer
S-10 and/or S-14 lenses
Aircrew frame
Aircrew lenses

Training Methods
Lecture/Discussion (23 hrs)
Demonstration (6 hrs)
Performance (45 hrs)

Multiple Instructor Requirements
1a, Safety, Equipment, Supervision (3 instructors for 10 hrs)
1c, Supervision (3 instructors for 14 hrs)
1d, Safety, Equipment, Supervision (3 instructors for 4 hrs)
1e, Safety, Equipment, Supervision (3 instructors for 5 hrs)
1f, Safety, Equipment, Supervision (3 instructors for 5 hrs)
1g, Safety, Equipment, Supervision (3 instructors for 12 hrs)

Instructional Guidance
Emphasize the importance of correct measurements in selecting a frame for the patient. Evaluate student's knowledge of frame availability and frame selection with worksheet II-1a. Frame availability questions will be answered and reviewed prior to practicing frame selection. Lens availability will be evaluated with II-1b. Use AFR 167-3 for demonstrating correct completion of DD Forms 771, Eyewear Prescription. Evaluation will be accomplished by completing 17 out of 20 DD Form 771's correctly. Stress the importance of verifying Rxs before notifying patients. Use worksheet II-1d for evaluation. Emphasize good patient rapport while demonstrating adjustments and evaluate using checklist II-1e. Repair of frames will be evaluated using checklist II-1f. Objective II-1g, demonstrate duplication of spectacles and evaluates using answer book (ANSI-STANDARDS). Use of chalkboard in lieu of slide set is optional at instructors discretion. Written test II-1 will be given following objective II-1d.

PLAN OF INSTRUCTION/LESSON PLAN PART I

NAME OF INSTRUCTOR	COURSE TITLE
	Optometry Specialist

BLOCK TITLE
Visual Acuity and Its Correction

1. COURSE CONTENT	2. TIME
2. Visual Acuity	24
a. Given WS J3ABR91235 000-II-2a, identify the anatomy and physiology of the eye with 70 percent accuracy. STS: 11c, 13b, 13c 13d Meas: PC	(8)
b. Given WS J3ABR91235 000-II-2b, identify facts about visual acuity with 70 percent accuracy. STS: 13a Meas: PC	(3)
c. Given the necessary materials and an instructor selected patient, perform visual acuity testing with no more than two instructor assists. STS: 14a(4)(a), 14a(4)(b), 14a(4)(c), 14a(4)(d) Meas: PC	(9)
d. Given the necessary materials and an instructor selected patient, take a case history with no more than one instructor assist. STS: 14a(1)(a) Meas: PC	(4)

SUPPORT MATERIALS AND GUIDANCE

Student Instructional Materials
SW J3ABR91235 000-II, Visual Acuity and Its Correction
WS J3ABR91235 000-II-2a, Anatomy and Physiology of the Eye
WS J3ABR91235 000-II-2b, Visual Acuity
SF Form 600, Chronological Record of Health Care

Audiovisual Aids
Slide Set, Visual Acuity
Slide Set, Anatomy and Physiology of the Eye
Flip Chart, Anatomy and Physiology of the Eye
Video Tape, The Orbit and Its Contents-CDM 01, Part 2

Training Equipment
Occluder
Projectochart
Snellen nearpoint card
Plus lens
Pin hole disc

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Training Methods
Lecture/Discussion (14 hrs)
Demonstration (2 hrs)
Performance (8 hrs)

Multiple Instructor Requirements
2c, Equipment, Supervision (3 instructors for 8 hrs)
2d, Supervision (3 instructors for 2 hrs)

Instructional Guidance
Identify the anatomy and physiology of the eye and evaluate by completing worksheet II-2a. Student's knowledge of visual acuity will be evaluated with worksheet II-2b. Demonstrate the measuring and recording of visual acuities. Stress the importance of the correct procedures in visual acuity testing. Evaluate students using checklist II-2c. Student's will record results on an overprinted SF Form 600. Demonstrate the use of good followup questions while obtaining a case history. SF Form 600 will be used to record results and evaluation will be from checklist II-2d. The use of the chalkboard or flipchart in lieu of the slide sets is at the discretion of the instructor. Use of PLATO IV may be for review or teaching. Written test II-2, will be given following objective II-2d.

3. Written Test and Critique 4

    a. Written test and critique II-1 (2)

    b. Written test and critique II-2 (2)

4. Military Training 6

    a. Physical conditioning Day 13 (2)

    b. Physical conditioning Day 18 (2)

    c. Physical conditioning Day 23 (2)

PLAN OF INSTRUCTION/LESSON PLAN PART I

NAME OF INSTRUCTOR	COURSE TITLE Optometry Specialist

BLOCK TITLE
Assisting the Optometrist

1. COURSE CONTENT	2. TIME
1. Ocular Motility	20
a. Given WS J3ABR91235 000-III-1a, identify the anatomy and physiology of the bony orbit with 70 percent accuracy. STS: 11a Meas: PC	(2)
b. Given WS J3ABR91235 000-III-1b, identify the anatomy and physiology of the ocular adnexa with 70 percent accuracy. STS: 11d, 14a(11) Meas: PC	(4)
c. Given WS J3ABR91235 000-III-1c, identify the anatomy and physiology of the extrinsic muscles with 70 percent accuracy. STS: 11b(1), 11b(2), 11b(3), 11b(4) Meas: PC	(5)
d. Given the necessary materials and an instructor selected patient, perform ocular motility tests with no more than one instructor assist per test. STS: 14a(5)(a), 14a(5)(b), 14a(5)(d) Meas: PC	(9)

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SUPPORT MATERIALS AND GUIDANCE

Student Instructional Materials
SW J3ABR91235 000-III, Assisting the Optometrist
WS J3ABR91235 000-III-1a, Bony Orbit
WS J3ABR91235 000-III-1b, Ocular Adnexa
WS J3ABR91235 000-III-1c, Extrinsic Muscles
SF Form 600, Chronological Record of Medical Care
Stein and Slatt, The Ophthalmic Assistant

Audiovisual Aids
Slide Set, Ocular Motility
Video Tape, Childhood Strabismus, An Approach of Nonophthalmologists-CDM-17
Transparency Set, Ocular Motility
Video Tape, The Orbit and It's Contents-CDM 01 Part 1
Flip Chart, The Bony Orbit
Flip Chart, Lacrimal System

Training Equipment
Occluders
Worth 4-Dot Sets
Anaglyph Glasses
Penlights
Prisms
Projectochart
Schirmer Tear Test
Skulls
Tongue Blade

Training Methods
Lecture/Discussion (10.5 hrs)
Demonstration (3.5 hrs)
Performance (6 hrs)

Multiple Instructor Requirements
1d, Equipment, Supervision (2 instructors for 3.5 hrs)
1d, Safety, Equipment, Supervision (3 instructors for 6 hrs)

Instructional Guidance
The study of the bony orbit will be aided by use of the color coded skulls. Evaluate this knowledge on worksheet III-1a. Evaluate the study of the ocular adnexa on worksheet III-1b. Evaluate knowledge concerning the extrinsic muscles on III-1c. Evaluate performance of diagnostic H test, cover test, and Worth 4-Dot test with Checklist III-d. The use of the prism bar will aid in creating motility anomalies for students to recognize. Instruct students to record results on an overprinted SF 600. PLATO IV (CAI) may be used for review or supplement teaching.

PLAN OF INSTRUCTION/LESSON PLAN PART I

NAME OF INSTRUCTOR	COURSE TITLE Optometry Specialist
BLOCK TITLE Assisting the Optometrist	

1. COURSE CONTENT	2. TIME
2. Ancillary Optometric Procedures	48
a. Given WS J3ABR91235 000-III-2a, identify the visual and pupilary pathways with 70 percent accuracy. STS: 11e Meas: PC	(3)
b. Given the necessary materials and an instructor selected patient, perform a pupillary reflex test with no more than one instructor assist. STS: 14a(8) Meas: PC	(3)
c. Given the necessary materials and an instructor selected patient, perform visual fields tests with no more than two instructor assists per test. STS: 16d(1), 16d(2), 14a(10) Meas: PC	(16)
d. Given WS J3ABR91235 000-III-2d, identify facts about ophthalmodiagnostic medications with 70 percent accuracy. STS: 16h Meas: PC	(1.5)
e. Given the necessary materials and an instructor selected patient, instill a nonharmful opthalmic drug with no more than one instructor assist. STS: 16g Meas: PC	(2.5)
f. Given WS J3ABR91530 000-III-2f, describe the procedures for performing Schiotz tonometry with 70 percent accuracy. STS: 16c(2) Meas: PC	(2)
g. Given the necessary materials and an instructor selected patient, perform NCT tonometry with no more than one instructor assist. STS: 16c(1) Meas: PC	(8)
h. Given the necessary materials and an instructor selected patient, determine the patient's blood pressure within 8 mm Hg of the rate determined by the instructor. STS: 14d Meas: PC	(4)
i. Given WS J3ABR91235 000-III-2i, identify signs and symptoms of common ocular referrals with 70 percent accuracy. STS: 12a, 12b, 12c, 12d, 12e, 17d Meas: PC	(4)
j. Given WS J3ABR91235 000-III-2j, identify characteristics of contact lenses with 70 percent accuracy. STS: 16b(1), 16b(5) Meas: PC	(2)

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k. Given WS J3ABR91235 000-III-2k, select information given to patients during contact lens orientation with 70 percent accuracy. STS: 16b(2), 16b(3), 16b(4) Meas: PC (2)

SUPPORT MATERIALS AND GUIDANCE

Student Instructional Materials
SW J3ABR91235 000-III, Assisting the Optometrist
WS J3ABR91235 000-III-2a, Visual and Pupillary Pathways
WS J3ABR91235 000-III-2d, Ophthalmodiagnostic Medications
WS J3ABR91235 000-III-2f, Schiotz Tonometry
WS J3ABR91235 000-III-2h, Blood Pressure
WS J3ABR91235 000-III-2i, Signs and Symptoms
WS J3ABR91235 000-III-2j, Characteristics of Contact Lenses
WS J3ABR91235 000-III-2k, Contact Lens Orientation
Harrington-Flocks Tachistoscope Charts
Visual Fields Charts-Brombach, Autoplot, Tangent Screen, Dicon 2000, Marco Bowl, Amsler Grid Charts
SF Form 600, Chronological Record of Health Care
Stein and Slatt, The Ophthalmic Assistant
SF Form 513, Consultation Sheet

Audiovisual Aids
Slide Set, Ancillary Optometric Procedures
Flip Chart-Visual and Pupillary Pathway

Training Equipment
Noncontact Tonometer
Schiotz Tonometer
Autoplot
Amsler Grid book
Penlights
Visual Fields Test Targets
Sphygmomanometer
Stethoscope
Alcohol Sponges
Tissue
Tachistoscope
Ophthalmic Drops (Artificial Tears)
Brombach Perimeter
Projection Perimeter
Dicon 2000
Marco Bowl Perimeter
Contact Lenses
Tongue Blade

Training Methods
Lecture/Discussion (17.5 hrs)
Demonstration (9.5 hrs)
Performance (21 hrs)

SUPPORT MATERIALS AND GUIDANCE (continued)

Multiple Instructor Requirements
2b, Equipment, Supervision (2 instructors for 1 hr)
2b, Equipment, Supervision (3 instructors for 2 hrs)
2c, Safety, Equipment, Supervision (2 instructors for 2 hrs)
2c, Safety, Equipment, Supervision (3 instructors for 11 hrs)
2e, Safety, Supervision (2 instructors for .5 hr)
2e, Safety, Supervision (3 instructors for 2 hrs
2f, Safety, Equipment, Supervision (2 Instructors for 1 hr)
2g, Safety, Equipment, Supervision (3 instructors for 8 hrs)
2h, Safety, Equipment, Supervision (3 instructors for 3 hrs)

Instructional Guidance
Evaluate the visual-pupillary pathway using worksheet III-2a and the pupillary reflex testing using Checklist III-2b. Separate visual fields into four areas: screening of central fields, diagnostic central fields, diagnostic peripheral fields and diagnostic macular fields and evaluate using Checklist III-2c. Evaluate identification of ophthalmodiagnostic medications on worksheet III-2d. Stress patient rapport during evaluation of instillation of ophthalmic drugs from checklist III-2e. Evaluate the procedures for performing a Schiotz tonometry on worksheet III-2f. Teach and demonstrate the noncontact tonometer, have students perform, then evaluate them by Checklist III-g. Evaluate blood pressure measurement from Checklist III-2h. Evaluate signs and symptoms of common occular referrals using worksheet III-2i. Evaluate identification of contact lens characteristics with worksheet III-2j and evaluate information given to patients during a contact lens orientation with worksheet III-2k. PLATO IV (CAI) may be used. Administer written test III-1 after objective III-2b and written test III-2 after objective III-2k.

3.	Written Test and Critique	4
	a. Written test and critique III-1	(2)
	b. Written test and critique III-2	(2)
4.	Military Training	4
	a. Physical conditioning day 28	(2)
	b. Physical conditioning day 33	(2)

PLAN OF INSTRUCTION/LESSON PLAN PART I

NAME OF INSTRUCTOR	COURSE TITLE Optometry Specialist

BLOCK TITLE
Vision Classification

1. COURSE CONTENT	2. TIME
1. Vision Classification	32
a. Given WS J3ABR91230 000-IV_1a, identify facts about depth perception with 80 percent accuracy. STS: 13e Meas: PC	(1)
b. Given the necessary materials and an instructor selected patient, administer steropsis tests with no more than one instructor assist per test. STS: 14a(7)(a), 14a(7)(b) Meas: PC	(3)
c. Given the necessary materials, perform Keystone visual skills on an instructor selected patient with no more than two instruction assists. STS: 14a(3) Meas: PC	(6)
d. Given the necessary materials, perform VTS-ND testing on an instructor selected patients with no more than two instructor assists. STS: 14a(2) Meas: PC	(7)
e. Given the necessary materials and an instructor selected patient, perform the amplitude of accommodation test with no more than one instructor assist. STS: 14a(9) Meas: PC	(2)
f. Given the necessary materials and an instructor selected patient, measure the near point of convergence with no more than one instructor assist. STS: 14a(5)(c) Meas: PC	(2)
g. Given WS J3ABR91235 000-IV-1g, identify types of color deficiencies with 70 percent accuracy. STS: 13f Meas: PC	(1)
h. Given the necessary materials and an instructor selected patient, administer color vision tests with no more than one instructor assist per test. STS: 14a(6)(a), 14a(6)(b), 14a(6)(c) Meas: PC	(6)
i. Given 10 selected visual acuity results and SW J3ABR91235 000-IV, classify the E portion of the physical profile with 70 percent accuracy. STS: 14c Meas: PC	(4)

SUPERVISOR APPROVAL OF LESSON PLAN

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SUPPORT MATERIALS AND GUIDANCE

Student Instructional Materials
SW J3ABR91235 000-IV, Vision Classification
WS J3ABR91235 000-IV-1a, Depth Perception
WS J3ABR91235 000-IV-1g, Color Deficiencies
WS J3ABR91235 000-IV-1i, PULHESX Profile (A and B series)
AF Form 718, Color Vision Threshold Test Record
SF Form 88, Report of Medical Examination
SF Form 600, Chronological Record of Medical Care
Keystone Skills Charts
Stein and Slatt, The Ophthalmic Assistant

Audiovisual Aids
Slide Set, Vision Classification
Transparency Set, Vision Classification
Mock-Up SF Form 88, Report of Medical Examination
Mock-Up AF Form 718, Color Vision Threshhold Test Record

Training Equipment
VTA-ND, Vision Testing Apparatus- Near and Distance
Verhoeff Steropter
Titmus Stereo Test
Pseudoisochromatic Plates
McBeth Lamp
Vision Testing Apparatus, Color Threshold
Farnsworth Lantern, Color Perception Testing
Prince Rule
Keystone Skills Telebinocular

Training Methods
Lecture/Discussion (10 hrs)
Demonstration (6 hrs)
Performance (16 hrs)

Multiple Instructor Requirement
1b, Equipment, Supervision (3 instructors for 2 hrs)
1b, Equipment, Supervision (2 instructors for 1 hr)
1c, Safety, Equipment, Supervision (3 instructors for 4 hrs)
1c, Safety, Equipment, Supervision (2 instructors for 1 hr)
1d, Safety, Equipment, Supervision (2 instructors for 1 hr)
1d, Safety, Equipment, Supervision (3 instructors for 5 hrs)
1e, Equipment, Supervision (3 instructors for 1 hr)
1f, Equipment, Supervision (3 instructors for 1 hr)
1h, Safety, Equipment, Supervision (3 instructors for 4 hrs)
1h, Safety, Equipment, Supervision (2 instructors for 2 hrs)

Instructional Guidance
Closely supervise all practice sessions and performance. Emphasize accurate test administration and proper recording. Evaluate knowledge

of depth perception with worksheet IV-1a, stereopsis tests with Checklist IV-1b, Keystone Telebinocular use with Checklist IV-1c, use of the VTA-ND with Checklist IV-1d, administration of amplitude of accommodation with checklist IV-1e, and performance of near point of convergence test with checklist IV-1f. Discuss the types of color deficiencies and evaluate with worksheet IV-1g. Color vision testing will be in three parts and evaluated by checklist IV-1h. AF Reserves and ANG should pay close attention to discussion of the physical profile; evaluate with worksheet IV-1i. Use of chalkboard or flipcharts in lieu of slide set is at the discretion of the instructor. PLATO IV (CAI) may be used for review or teaching. Give written test IV-1 following objective IV-i.

2. Written Test and Critique IV-1 2

PLAN OF INSTRUCTION/LESSON PLAN PART I

NAME OF INSTRUCTOR	COURSE TITLE Optomitry Specialist

BLOCK TITLE
Clinic Management and Practicum

1. COURSE CONTENT	2. TIME
1. Chemical Warfare Defense Training	2

a. Identify, with 60 percent accuracy, factors pertinent to medical operations in a chemical warfare environment: STS: 2e, 2f Meas: PC

(1) The evolution and potential threat of chemical warfare.

(2) The USAF concept of medical operation in a chemical warfare environment.

(3) Names and functions of chemical warfare protective equipment.

(4) Medical aspects of five major categories of chemical warfare agents.

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SUPPORT MATERIALS AND GUIDANCE

Student Instructional Materials

SHCS HO 3, Basic Medical Aspects of Chemical Warfare Agents
SHCS HO 4, Chemical Warfare Protective Equipment

Audiovisual Aids

35mm Slide Set, Threat/Concepts
35mm Slide Set, Basic Medical Aspects of Chemical Warfare Agents

Training Equipment

Chemical Warfare Protective Equipment (one set)

Training Methods

Lecture/Discussion (2 hrs)

Instructional Guidance

This 2 hour lesson on Chemical Warfare Defense Training and the progress check will be presented by the Training Branch of the SHCS, USAF/MSDR.

The primary instructor for each class is responsible for contacting MSDR/Training Branch staff to coordinate arrangements for this presentation. If no suitable time can be agreed upon, then primary instructor may schedule their students to receive this training via PLATO.

MSDR Training Branch staff will present a threat briefing; then, factors pertinent to the USAF concept of medical operations in a chemical warfare environment will be discussed and chemical warfare personal survival equipment shown and explained. Finally, the medical aspects of chemical warfare agents will be discussed.

MSDR Training Branch staff will coordinate the results or progress check with course personnel and make arrangements for any followup action required.

PLAN OF INSTRUCTION/LESSON PLAN PART I

NAME OF INSTRUCTOR	COURSE TITLE
	Optomitry Specialist

BLOCK TITLE
Clinic Management and Practicum

1. COURSE CONTENT	2. TIME
2. Clinic Management	7
a. Given WS J3ABR91235 000-V-2a, identify specific OPSEC vulnerabilities of AFSC912X5 with 70 percent accuracy. STS: 3 Meas: PC	(1)
b. Given WS J3ABR91235 000-V-2b, identify medical materiel procedures with 70 percent accuracy. STS: 6a, 7a, 7b, 7c Meas: PC	(4)
c. Given WS J3ABR91235 000-V-2c, identify basic facts about the eye safety program with 70 percent accuracy. STS: 14b Meas: PC	(2)

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SUPPORT MATERIALS AND GUIDANCE

Student Instructional Materials
SW J3ABR91235 000-V, Clinic Management and Practicum
WS J3ABR91235 000-V-2a, OPSEC
WS J3ABR91235 000-V-2b, Medical Material
WS J3ABR91235 000-V-2c, Eye Safety Program

Audiovisual Aids
Slide Set, Block V Review
FSC 6500 AL
FSC 6515 IL
FSC 6540 ML

Training Methods
Lecture/Discussion (7 hrs)

Instructional Guidance
Emphasize to students the importance of OPSEC vulnerabilities in AFSC 912X5 and evaluate with worksheet V-2a. Discuss publications and medical materiel procedures with emphasis on practical application in the clinic and evaluate with worksheet V-2b. The importance of the occupational vision program is in screening, examining, and ordering of safety glasses. Evaluate with worksheet V-2c.

PLAN OF INSTRUCTION/LESSON PLAN PART I

NAME OF INSTRUCTOR	COURSE TITLE Optomitry Specialist

BLOCK TITLE
Clinic Management and Practicum

1. COURSE CONTENT	2. TIME
3. Practicum	40
a. Given WS J3ABR91235 000-V-3a, select the required steps used to schedule appointments with 80 percent accuracy. STS: 17a, 17e Meas: PC	(1)
b. Given WS J3ABR91235 000-V-3b, identify procedures involved in instrument user maintenance with 80 percent accuracy. STS: 17c Meas: PC	(1)
c. Given the necessary materials and instructor selected patients, perform four visual screenings with no more than three instructor assists per patient. STS: 14a(1)(b) Meas: PC	(38)

SUPPORT MATERIALS AND GUIDANCE

Student Instructional Materials
SW J3ABR91235 000-V, Clinic Management and Practicum
WS J3ABR91235 000-V-3a, Appointment System
WS J3ABR91235 000-V-3b, Instrument Maintenance
SHCS HO 1, Anyone You Know?
DD Form 741, Eye Consultation
SF Form 88, Report of Medical Examination
SF Form 513, Consultation Sheet
SF Form 600, Chronological Record of Medical Care

Training Equipment
+1.25 Diopter Sphere lens
Occluder
Noncontact Tonometer
PD Rules
Lensometer
Projectochart
Pinhole disc
Penlight
Stereo Fly, Titmus
Worth 4-Dot
Frame fitting set
VTA-ND
Snellen Near point card

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SUPPORT MATERIALS AND GUIDANCE (continued)

Training Equipment
Keystone Telebinocular
Pseudoisochromatic Plates
McBeth Lamp
Optician's tools

Training Methods
Lecture/Discussion (2 hrs)
Demonstration (2 hrs)
Performance (36 hrs)

Multiple Instructor Requirements
3c, Safety, Equipment, Supervision (3 instructors for 36 hrs)
3c, Equipment, Supervision (2 instructors for 2 hrs)

Instructional Guidance
Stress the importance of appointment system and evaluate with worksheet V-3a. Emphasize the maintenance of instruements at the clinic level and evaluate with worksheet V-3b. Using the whole-part-whole concept, check student's ability to appropriately integrate various practical combinations of all tasks and knowledges. The practicum will be accomplished with uniform monitoring of student performance. During the practicum the students will normally be divided into groups so that each student may be provided a minimum of one day of experience at SHCS Simulated Optometry Clinic or at Sheppard Regional Hospital Eye Clinic. At least one instructor will accompany each student group. Additional assistance within the hospital eye clinic will be rendered as needed by the chief of optometry or his representative. In order to permit time to answer class critique, it is permissible to conduct the class critique during the first day of practicum instead of the last day of the course. Course critiques will be answered on the last day of the course just prior to graduation. Student duties will include but not be limited to the following tasks: Prepare DD Form 741 and SF Form 600; obtain a valid case history; obtain visual acuities; use the pinhole and plus lens screening test; perform diagnostic H, accommodation, NPC, Worth 4-Dot, and cover test; use the stereo fly to measure stereopsis; obtain pupillary relfexes; determine spherical equivalents; transpose ophthalmic Rxs; convert from bifocals near Rxs; determine whether or not ordered glasses meet ANSI standard; measure PD and multifocal heights; conduct NCTs; and adjust spectacles to fit the patient. All conditions and standards will comply with criterion objectives on these subjects, although the number of performance items for each individual may be less than in the original criterion objective due to limitations. Air National Guard and Air Force Reserve students may do a visual physical exam using the instruments and forms normally used for physical exams, time permitting. Time may be allotted during each day of the practicum to allow for discussion of problems the students may be experiencing. Written test V-1 will be administered following objective V-3c. PLATO IV may be used in lieu of lecture.

SUPPORT MATERIALS AND GUIDANCE (continued)

4.	Written Test and Critique V-1	2
5.	Course Critique and Graduation	3
6.	Military Training	12
	a. Physical conditioning Day 38	(2)
	b. Physical Conditioning Day 43	(2)
	c. End-of-Course appointments; Predeparture Safety Briefing	(8)

STUDY GUIDE AND WORKBOOK

J3ABR91235 000-I

Technical Training

Optometry Specialist

BLOCK I

INTRODUCTION AND BASIC OPTICS

February 1984

SCHOOL OF HEALTH CARE SCIENCES, USAF
Department of Biomedical Sciences
Sheppard Air Force Base, Texas 76311

Designed for ATC Course Use RGL: 10.8

DO NOT USE ON THE JOB

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Department of Biomedical Sciences
School of Health Care Sciences, USAF
Sheppard Air Force Base, Texas 76311

SW J3ABR91235 000-I-1
February 1984

ORIENTATION

OBJECTIVES

Unit one of this Study Guide (SG) will welcome you to Course J3ABR91235, Optometry Specialist, and the Department of Biomedical Sciences, Sheppard AFB, Texas. It will acquaint you with the course, the policies of the School of Health Care Sciences (SHCS), your chain of command, and your responsibilities while a student here. During this unit of instruction you will receive information on:

a. Course welcome, course content, and administration.

b. Course and school policies.

c. Types and use of instructional materials.

d. Effective study procedures.

e. Fraud, waste, and abuse.

f. Conservation of training materials, resources, and energy.

g. Community College of the Air Force.

h. Student critique program.

i. Safety in the training environment.

j. Testing and grading system.

k. Career ladder progression.

l. Vision care specialists.

m. Introduction to Plato.

INTRODUCTION

Four hours will be spent processing you into the course. After the class welcome and the required processing, regular class will begin.

INFORMATION

COURSE WELCOME

At this time, we would like to take a few minutes to welcome you to the course, the Department of Biomedical Sciences and the School of Health Care Sciences.

The School of Health Care Sciences trains personnel for most of the jobs in the Air Force health care field. There are beginning and advanced courses for airmen and officers. These courses are staffed by highly competent instructors and support personnel who constantly strive to provide you with an up-to-date and interesting course. They will make your transition into the medical career field as smooth as possible.

Within the School, there are six teaching departments - Biomedical Sciences, Dentistry, Medicine, Nursing, Health Services Administration and Medical Readiness. The optometry course falls under the Department of Biomedical Sciences. Some of the people you need to know in your chain of command are listed below. Write in their names when the instructor presents this section. Course personnel are in Room 2063, extension 6410 or 6232. From off base, the phone number is 851-6410.

At various times during this course, you will be required to know certain information. This information will identify you on administrative forms, class rosters, and for grading purposes. Write in the information when it is given to you.

Course Title Optometry Specialist
Course Number J3ABR91235
Course Length 9 weeks
Class Number ____________
Code Number ____________
Graduation Date ____________

One of the benefits of attending Air Force courses is the opportunity to meet other people and exchange personal experiences and ideas. This intercommunication will take place during classroom hours, but even more so after class. Many problems which are discussed during class hours may be solved after hours. It is the sincere desire of the staff to develop the Optometry Specialist Course around the idea of interpersonal communication.

In order to create an atmosphere for the free interchange of ideas, each attendee should be familiar with the general background of his/her classmates and instructors. You will have the opportunity to introduce yourself to your classmates and instructors during orientation. The following outline will assist you in making a brief personal introduction to the class.

1. Your name and base assigned (if known).
2. Schools attended and year graduated.
3. Previous military experience.
4. Civilian experience (jobs you have held).
5. Any specialty training you have had.
6. Marital status and number of dependents.
7. Why you are attending the Optometry Specialist Course.

Course Content

There are five blocks with titles and hours* as follows:

Block I - Introduction and Basic Optics - 72 hours
Block II - Visual Acuity and Its Correction - 102 hours
Block III - Assisting the Optometrist - 72 hours
Block IV - Vision Classification - 34 hours
Block V - Clinical Management and Practicum - 54 hours

*8 Hours equal one day.

Administration

You may be issued some course materials on an AF Form 1297, Hand Receipt. You will be held financially responsible if these are lost or damaged. Please do not write in or otherwise mark these materials.

Safety in the Training Environment

You will be given an Optometry Safety Sheet to read and sign. Take heed of the points mentioned, they're for the protection of you and your fellow students.

Course and School Policies

1. Building, Classroom, and Time

You have been assigned to Regular shift and will be attending classes in Building 1900, Room(s) 2077/2079. It is necessary that you be present, seated, and ready for instruction at 0700 hours each day. Normally courses are conducted eight hours per day, five days per week. This schedule may be altered slightly at the discretion of the instructor during performance testing.

2. Shifts

The shifts are called "A:, "B", "C", "D", and Regular. "A" Shift runs from 0600 until 1150; "B" shift runs from 1210 until 1800; "C" shift runs from 1810 until 2400; and "D" shift runs from 0010 until 0600. Regular shift runs from 0700 until 1600 hours.

a. When on "R SHIFT" you are to be in your seat and ready for class at 0700 hours.

b. Hang coats, hats, etc., on the racks in Room 2077/2079.

c. During lecture hours, the following schedule will be in effect:

Class		Break
0700 - 0750	--	0750 - 0800
0800 - 0850	--	0850 - 0900
0900 - 0950	--	0950 - 1000
1000 - 1050	--	
Lunch 1050 - 1210		
1210 - 1300	--	1300 - 1310
1310 - 1400	--	1400 - 1410
1410 - 1500	--	1500 - 1510
1510 - 1600	--	

* RETURN FROM BREAKS PROMPTLY

d. When in performance areas, breaks will be allocated at the discretion of the instructor.

3. Class Attendance

Class attendance is mandatory and consistent tardiness is inexcusable. If you cannot attend class, first notify the class leader. If you cannot notify the class leader, call the course supervisor. Explain your reason for the absence. If you are sick, refer to Section 12 of this Study Guide. Remember: Attendance is mandatory unless you have an official excuse to be absent. Absences for any reason must be approved by the course supervisor or a desginated representative.

4. Code Number

You will be given a code number based on your alphabetical position on the class roster. This number is used for administration and identification of your tests throughout the course. Be sure to memorize it!

5. Seating Arrangement

Specific seating assignments in the classroom are not required. If you have a medial problem that requires a specific seating consideration (e.g. hearing or vision deficit), bring this to the instructor's attention immediately. Otherwise, you may sit in any of the assigned seats.

6. Class Leader Duties

A class Leader will be assigned during the first day of the course. The Class Leader may be the highest ranking class member, or someone chosen regardless of rank or other position. The Class Leader is a representative of the course officials and will have authority to deal with assigned responsibilities. Duties include, but are not restricted to:

a. Maintaining a current class roster.

b. Checking the roll and reporting any absence, emergency leave, on-duty sick-call, or tardiness to the instructor.

c. Maintaining a detail roster (to be rotated among members throughout the course) for classroom clean-up.

d. Assisting the instructor in maintaining order in the classroom and directing the activities of the class in the absence of the instructor.

e. Provide the staff with possible insights to student's grievances and problems.

f. Calling class to position of attention (sitting) at the beginning of class (if required) or when visitors enter (if previously announced).

g. Conducting evacuation during fire drills and tornado alerts in the absence of the instructor.

h. Collecting money for class photo.

The instructor will brief the class leader on specific details or any additional duties not listed above.

7. Classroom Behavior

a. You are responsible for proper classroom behavior. Discrepancies will be recorded on ATC Form 341 and will result in disciplinary action.

b. You are required to be at your desk on time and to return from breaks promptly.

c. Food, beverages, gum, and cigarettes may be used in designated break areas only -- not in the classroom. No portion of the second floor is a designated break area.

d. Keep the immediate area around your desk clean.

e. Horseplay, sitting on desks and tables, and the wearing of sunglasses in class is not permitted.

f. If you feel drowsy, ask the instructor for permission to stand at the rear of the room for a while. Asking questions will keep your mind alert. Sleeping in class or sitting at your desk with your eyes closed is not permitted.

g. Never abuse or mark on anything that does not belong to you. You are reminded that you are financially liable under the Uniform Code of Military Justice for the destruction of government property. This includes the text books issued to you for the duration of the course.

h. Regardless of the rank of your instructor you will afford him or her the courtesy of your attention. They have the responsibility for maintaining classroom discipline. As a student, you fall under the supervision of the instructors during your hours of duty as a student, regardless of your rank or theirs. Aggravated disrespect for the instructor staff is inexcusable and is punishable.

i. Attending classes while intoxicated will not be permitted.

j. Always conduct yourself in the way you wish others to conduct themselves. As an airman, you are expected to conduct yourself in a manner which will reflect credit on yourself, your career field and the Air Force.

k. Hang coats and hats on the racks in the classroom.

Remember: The following is NOT permitted in the classroom:

(1) Sunglasses worn in class

(2) Chewing gum

(3) Eating food

(4) Smoking

(5) Sitting on desks and tables

(6) Sleeping

(7) Horseplay

(8) Noise, loud talking, profanity

8. Breaks

Time is set aside each hour to give you a few moments to relax, smoke, or have a snack. This increases training efficiency and should contribute to your comfort and morale. Breaks are regulated by a schedule (see Section 2) and are monitored by the class instructors. You are required to leave the classroom during these break periods. Break areas are designated for your class. Do NOT take breaks in the hallway. Other classes may be in session. Do not take breaks in the office. Hot and cold beverages and snacks are available in vending machines in the lower West Wing of Building 1900. A small BX is also located in this area. Loitering, smoking, eating, or drinking beverages is not permitted in the stairwells or on the balcony. Each student is charged with the responsibility of keeping the break area clean and litter free. Any area found littered will be policed by students.

9. Cheating on Examinations

Cheating is interpreted to include the following: Possession of testing or exercise materials and/or solutions to problems prior to evaluation time, unless such material was given to all students by the instructor.

Having "cribbing" materials in one's possession, or available for use during an evaluation period. "Cribbing" materials include specific test answers, or notes, which would assist the student in taking the test. Use of notes or materials in "open book" examinations is not cheating. The instructor will specify when such materials are allowed.

Receiving or giving assistance in any form during an evaluation, this assistance includes copying from another's paper, or passing or receiving information about the test, either written, by signal, or orally. This also includes comparing findings during performance tests.

Instructors and course supervisory personnel will be alert to prevent cheating. Whenever a student is found to have cheated, he/she will be considered by a Faculty Board for elimination "with prejudice."

Students are expected to progress in the course of instruction on their own capability and effort. Cheating on assignments, progress checks and written examinations will not be permitted. In the event cheating is detected under any circumstances, necessary action will be taken in accordance with appropriate regulations.

10. Chain of Command

If at any time you have a problem or need help, ask your instructor first. If he/she is unable to solve the particular problem he/she will make an appointment for you to see the Instructor Supervisor or the Course Supervisor.

School Commander______________________________

Department Chief______________________________

Course Supervisor______________________________

Instructor Supervisor___________________________

Instructors__________________________________

____

____

11. Special Individualized Assistance (SIA), Elimination, and Proficiency Advancement

If you fail a Progress Check or score below 70% on block tests, you will be counseled and placed on SIA. If you fail an end-of-block examination, SIA is mandatory, and the instructor involved will schedule this training for you. It will be six hours of instruction for each Progress Check or written test in which a failing grade is received. You may be allowed to continue into the next block on a probationary basis. After SIA, you will be retested. If you fail the test again, you will be eliminated. Any student having difficulty maintaining a day-to-day pace of instruction may request help through voluntary SIA. However, SIA will not be administered to help a student achieve grades sufficient to receive Honor Graduate recognition. For those assigned to mandatory SIA, you will be given an STTC Form 775 showing when you are required to return to training.

Students who are able to demonstrate previous achievement in the skills of a basic course, either in terms of education and/or experience, may be considered for proficiency advancement. This means that you may be allowed to advance through a portion of the course after you have proven your abilities through testing and interview. If you are interested or feel qualified, consult your course supervisor as soon as possible.

12. Sick Call

If you should become ill before class, follow squadron procedures for sick call and notify your class leader, who will in turn notify the instructor or instructor supervisor. If you should become ill during class, inform the instructor. An appointment will be made for you at the hospital. After duty hours, personnel will be seen in the hospital emergency room. Remember, your presence must be accounted for at all times. If you have a medical or dental appointment, inform the class leader of the date and time and he will make a record of it. Also, you must have approval on STTC Form 62 from the instructor or instructor supervisor involved. Students going on sick call during class hours may be required to make up work missed by attending SIA. Please attempt to schedule appointments for other than school hours. Excessive absence may result in recycling or elimination.

13 Emergency Leaves

No time may be taken off from class during this course except for hospitalization or emergency leave. Emergency leave is not granted unless the emergency is verified by the American Red Cross. Please notify your next of kin that in case of an emergency requiring your presence at home, they must first notify the Red Cross, since verification is required before you can depart. When returning to school from emergency leave or hospitalization, report to your block or course supervisor as soon as possible. Absences of over 3 days usually require recycling to another class. Off-duty travel over weekends and holidays is permitted, but you are responsible to attend the next scheduled class following the weekend or holiday.

14. Personal Appearance

It is mandatory that you present a neat appearance at all times.

The uniform for the day is fatigues, unless otherwise specified for field trips, hospital duty, graduation, or the class photo. Violations of appearance invite counseling and possible disciplinary action. Conform with dress standards as outlined in AFR 35-10.

15. Class Photo

Some classes desire a class photograph. If your class chooses to do so, the photograph will be taken at _______ hours on ____________________. Although purchase of the class photograph is optional, your presence is mandatory. The cost of the photograph and the procedures for ordering it will be discussed with you by the photographer. In some courses, the class leader is responsible for processing the orders. The uniform for the photograph will be ____.

16. Visits by Officials

Frequently, high ranking officers and civilians visit the classroom. When visitors enter the classroom, you should carry on in a normal manner unless the instructor directs otherwise. Please refrain from looking to the rear of the room every time you hear the door open. If a visitor should address a question to you, stand and answer the question to the best of your ability. If you do not know the answer, state that you do not know in a simple, courteous manner.

17. Fire Drills and Tornado Alerts

You were taught the basic alert signals for fire and tornado emergencies at Lackland or have used them in previous assignments. Your actions are regulated by these signals while at the squadron or on base. Because the base alert signals cannot be heard while inside the school, a separate alarm system has been established. A bell signifies a tornado alert and a klaxon horn a fire drill. In the event of a fire drill, the instructor will immediately dismiss the class. You will evacuate the building by the nearest east side exit, after having turned out all lights and closed all doors. During a tornado or other disaster alert, you will be directed to a shelter inside the building. Follow the directions of the disaster personnel in charge. The tornado shelter rooms are identified by an "S" over the room number and are clearly designated on the bulletin board. You should familiarize yourself with them. In the absence of a shelter supervisor, the class instructor will take charge of the evacuation. Instructions for fire drills or alerts are posted on bulletin boards of every classroom. Here is a quick review of the procedures:

Fire Drill (Klaxon horn)

a. Turn out all lights and close doors.

b. All students will leave the building immediately by the east side.

c. Be quiet and orderly; do not run.

d. Assemble on the east side of Building 1900.

e. Return to the classroom when the "all clear" has been given.

Tornado or Disaster Alert (Bell)

a. Turn out all lights and close doors.

b. Leave classroom immediately.

c. Be quiet and orderly; do not run.

d. Follow directions of disaster personnel in charge. If no one is available to issue immediate orders, follow instructions of the class instructor and proceed to any room on the first floor identified as a shelter by a small (approximately 2 x 4 inch) red sign with a white "S" marked above the door.

e. Return to the classroom when the "all clear" sign has been given.

18. Details

This is your duty section and it is everyone's responsibility to maintain cleanliness. Everyone will keep the immediate area of their desk neat and free of litter. Where applicable, students will wipe the top of their desk. The class leader will insure that the break area is cleaned up after each break, and will designate a detail person to:

a. Wash chalkboards.

b. Dust erasers.

c. Empty wastebaskets.

d. Clean floors.

e. Align desks.

f. Assist instructor in setting up equipment or distributing training materials.

19. PCS Assignments

All major air commands send their vacancies in the 91235 field to the Military Personnel Center at Randolph. Randolph compiles the vacancies that need to be filled by graduates of Course J3ABR91235, and sends this information to the Airman Assignments Section at Sheppard. Shortly after you arrive here at Sheppard, you are given the opportunity to indicate the base(s) to which you would like to be assigned. The Airman Assignments Section keeps your preferences in their files until they make your permanent assignment. If the Assignments Section has a valid opening at the base to which you prefer to go, they will assign you there. If the base of your preference does not need someone to fill a valid vacancy in the 91235 field, the Assignments Section will try to place you in the locale (area) of your choice. If there are no openings in the area of the country that was your first preference, they will assign you to any place they need you. They always try to match your preference with a base that has a valid vacancy for someone in your field, or secondly to the area of your choice. But remember that your base of preference may not have a valid vacancy at the time assignments are made.

If you change your mind as to where you want to be assigned before your assignment is made, visit the Airman Assignments Section at CBPO and change your assignments preference card.

20. Training Evaluation

Our concern for you and your Air Force career does not end when you leave the School of Health Care Sciences. We are interested in your job assignment and we particularly want to know whether we have trained you properly for your assignment.

To gather information about our training we use direct mail questionnaires and field interviews. Thus, when you have been at your first assignment from three to six months, you will very likely receive a questionnaire from our Training Evaluation Division. This questionnaire will ask your opinion regarding how well the training here at Sheppard prepared you for your job assignment. It will also ask for your suggestions to improve our training. When you receive a questionnaire, please complete it and return it promptly.

Another means of gathering feedback information from our graduates and their supervisors is the field interview. Again, some time between the third and sixth month after graduation, you may be visited by a training evaluator from the school. He will talk with you about your training and how well it has prepared you for your job. Feel free to speak frankly with him. We are vitally interested in your suggestions.

Meanwhile, if you have suggestions or comments concerning your training while here, feel free to discuss them with your instructor or the course instructor supervisor.

Types and Uses of Instructional Materials

You will be issued textbooks and selected supplies for use in the course on a hand receipt. You will be held financially responsible if these are lost or damaged. Textbooks and supplies must be used by classes following yours. Do not mark them or damage them in any way. Reference books may be checked out of the office on a hand receipt. Study Guides and Workbooks are yours to use, study and keep. It is suggested that you keep your Study Guides, Handouts, and personal notes in a ring binder so as to keep all material handy and in a logical sequence. This can then become a part of your desk reference file, when you go to your base, and help you study for the 5-level.
All other material not specifically designated will be returned before you are allowed to graduate.

Daily study out of class will be necessary for those who hope to graduate from this course. During the course, you will be given Study Guides/Workbooks (SW) covering each subject area. The objectives state what is expected of you at the completion of each lesson. Exercises are provided for you to complete, and study references are listed for you to study before you come to class. Reading these references will enable you to participate in class discussions and complete the exercises in your workbook. Your Study Guide also has provisions for daily notes. Your are required to complete all Study Guides issued to you. To aid you further, several reference volumes can be checked out to the class leader or to individual students for use at the dormitory.

Effective Study Procedures

In order to learn, you've got to get ready. Channel swimmers would not plunge in at Dover and swim to France without a period of physical training. They would spend long hours of routine practice perfecting their techniques. In some respects, study is like channel swimming; you must train yourself in certain methods and routines to develop mental habits, that perhaps have been long neglected or have not been developed at all. For success in your course work, you must adjust yourself quickly to good study habits; remember that failing students usually have poor study habits.

1. In the Classroom:

a. Your job in the classroom is to listen, understand, ask questions when you don't understand, and to take notes to help you learn and remember. Most failing students keep poor notes. Try to make yours good and strive to improve your note-taking ability. Take notes constantly. Here are some things that happen when you steadily take notes:

(1) It keeps your mind from wandering.

(2) It gives you many pages of actual study material, rather than a few unrelated words and hen scratchings.

(3) It makes the time go rapidly. This is important, because you don't get bored and fall into that fatal habit of day dreaming or semi-sleeping.

(4) It definitely helps you to remember because you use more of your senses. All learning comes through your senses. Believe it or not, you don't remember very well the things you hear. In most situations, 86 percent of learning is by seeing and only 14 percent by hearing. Psychologists tell us that we write, we remember because we see the material and work with it.

b. Here are some points to remember about taking notes:

(1) Keep your mind active by summarizing. Try to determine exactly what main point the lecturer is putting across. Write down the gist of it in outline form in a few words with an Arabic (1,2,3, 4, etc) number in front of it. Then jot down underneath the main heading as many minor points about the idea as you can. Numbering is important since it helps you organize your notes. Continue this process for each new main point that is discussed. Don't try to get down every word the instructor says or copy from your book word by word. Determine the main idea; then jot down as many points under the main idea as possible.

(2) Copy in total those visual aids and charts used in your classes. Many instructors build their lectures around charts and blackboard diagrams, using these for introductions, detailed explanations and summaries. If you copy them, you may have the heart of the lecture right in your own notebook.

(3) Read your notes immediately after class and fill in the blank spots. In most lectures you have to leave out important items because of the speed of the talk. Immediately after class you will be able to remember those points, but not later on. If you can't remember, one of your classmates may be able to do so. Ask them.

(4) Write yourself questions. Psychologists have found that people cannot learn things when there are nagging questions in their mind. So, if you have questions on items that you have missed, or about anything else, write yourself questions in the margin of your notes. Work out the answer after class. The desire to find answers to interfering questions that flash into mind has been found to be a main block to learning. By writing these questions, you will clear your mind and permit yourself to concentrate on the lecture. If the questions are about the subject being discussed, remember that here at the School is the best place to find the answer. Just ask the instructor.

(5) Make yourself assignments and do them. Keep an assignment page at the back of your notebook; keep your assignments checked off as you finish them.

2. At Home:

a. After you have assembled a batch of notes and handouts which summarize past lecture periods, your next concern is to clinch this material - to learn it so you can recall it when needed. To learn anything, you have to make a pattern for it in your mind - you must organize it first. Then go over and over the material until you are able to talk with your buddies about it. Be sure to organize, repeat, and talk about everything you study.

b. To learn easily and quickly, find a method of studying that has proved to be effective for you. The principle is to follow this method every night for each of the instructional hours of a day in class, whether you are to be tested the next day or not. When studying for a test, assemble all the notes and handouts for the block of hours to be covered and take the following steps in order.

(1) First, survey the material. Look it over briefly and familiarize yourself with the general plan or idea of what you are to learn. This will show the overall picture; getting this picture is the most important step in learning. This is the first step in making the all-important pattern in your mind.

(2) Ask yourself questions about the material you are studying. What is this? What shall I know when I am finished? By asking yourself questions, you will help determine just what it is you are trying to learn. (Many people study hard without determining just what it is they are trying to learn.) You need to know where you're going in studying just as going on a trip - before you start.

(3) Read. First, scan all of your materials, get the overall picture. Then read in detail. In addition to the printed material, read the diagrams in your books and handouts. They often summarize the entire unit of study, or create a good mental picture where a hazy blur of concepts had existed before.

(4) Review. Go over all material.

(5) Recite. Talk about the material with one of your classmates; as questions. See who knows the answers to questions you thought of. Get someone to ask you questions. What you don't know, go over again.

Tips on Study Habits

Motivate yourself. In order to learn anything well, you must want to learn it. If you can determine for yourself just why you are learning a particular subject, you will become more interested in it and find yourself wanting to know more and more about it. Remember that studying is your main job during the short time you are in school, so hit it hard. There will be plenty of time for fun after you finish the studying. You'll enjoy fun time more if you feel that you have done a good job with your school work.

Schedule your time. Set up a study schedule and stick to it. Allot a definite period for each subject that you must cover. Preplan your day's work.

Get to Work. Get to work and get your studying done; nobody is going to do it for you. You can't learn while you're half asleep. You have got to focus your attention on what you're to learn. If you get sleepy in class or while studying at night, try a soft drink or some coffee. If day-dreaming interferes with your studying, stop and write down the things that keep coming into your mind. You can think about them again after you are through studying. Even the most difficult study assignments will seem to have been easy when you finish them and can look back to wonder what you were worrying about in the first place. Don't let that homework pile up; that could lead to disaster.

Develop Good Study Habits

1. Study, if possible, the same hours each day. Start studying the minute you sit down at your desk; Start going through the motions. You will be surprised how soon you will become interested and well into your task. Keep distractions off your desk and out of your room.

2. Keep your notes grouped properly. You will tend to associate facts clustered together in your notebook.

3. Always be prepared for tomorrow. Learn all previous material you have on each subject so that you will be ready for any new material. Review all work systematically, whether there is an impending examination tomorrow or a month from tomorrow. Review often to save time and energy just before a test. There are many things that may come up just before the test that may deprive you of "cramming time."

4. Keep a list of technical words. Underline each word you do not understand in the study material. Look up these words and add them to your list. In this way you can develop a technical vocabulary in your field.

5. Always look for something when you read. Don't just read. Look hard, and read hard and fast.

6. Don't attempt to memorize all the facts. Organize the material in your mind by trying to grasp the ideas or concepts; then after a little more concentrated study, the details will fit into the overall picture.

7. Don't loaf while studying; work up to your full capacity.

Energy Conservation

It behooves the USAF as one of the nation's largest organizations to conserve as much energy and resources as possible, thereby setting an example for others to follow. Energy and resource conservation benefits most from a lot of people doing small and often insignificant things. It is not a great, individual hardship to conserve energy although it will be unless you do your part now! Some suggestions to follow, while in this course, are listed below:

1. Turn off water faucets completely.

2. Use only one paper towel to dry your hands.

3. Turn off instruments when not in use.

4. The last person out of a room should turn off the lights.

Community College of the Air Force (CCAF)

The Community College of the Air Force is a unique occupational education institution designed specifically for the enlisted men and women of the United States Air Force. The college offers you the opportunity to broaden your education and attain higher skill level as an Optometry Specialist. The program is open to all USAF Regular, Reserve and ANG personnel who complete this course. Sixty-four semester hours are required to receive an Associate in Applied Science Degree (AAS), in Optometric Technology, with the Optometry Specialist Course awarding 17 semister hours and Basic Training awarding four semester hours. For enrollment and further information on degree requirements see you Base Education Office.

Student Critique Program

You will be given the opportunity to complete critique forms while here at Sheppard AFB. To critique something is to express your opinion about it. This program exists because we are interested in student welfare and the effectiveness of our training. It is based upon the assumption that whatever bothers or distracts the student will adversely affect learning. You will, therefore be given a chance to express your opinion concerning your training and the student environment and to give us your constructive criticism. Be as factual and explicit as possible.

Since the critique program began, many improvements have been made as a result of student recommendations. Critiques are not mandatory, but can be completed at any time. Your completed critiques will be given careful consideration; they are an important management tool in the administration of the school.

Testing and Grading System

Throughout the course, you may be tested several different ways to insure achievement of criterion objectives. An objective is simply a statement that tells you what you will be expected to learn/perform, under what conditions, and how well you must complete the task. All objectives are based on the prescribed Specialty Training Standard (STS). Each of these STS items must be tested during the course and successfully completed. Most of this testing will be accomplished by the use of progress checks. A progress check is a written or performance exercise on a particular subject. In addition, instructors will give oral or written quizzes to insure satisfactory accomplishment of all lessons. Block tests will be given over a larger area of subject matter to insure retention of broader subject knowledge. A 70% score is required to pass all Block Tests. Performance tests are used for patient oriented tasks and given in a formal mode. Failure of any progress check, block test, performance test, or quiz will result in counseling, mandatory SIA, and possible elimination from the course, if re-tests are not passed.

Career Ladder Progression (See Figure 1-1)

The Optometry Specialist Course will train you to perform the basic procedures to the 3 skill level. To be awarded the 5 skill level, you will be placed in Up-Grade Training (UGT) where you receive On-The-Job Training (OJT) in the clinic and take a Career Development Course (CDC). The CDC will expand on the information you receive here in the course. Upon completion of OJT and the CDC you will receive your 5 skill level.

In order to receive your 7 level, you must be a Staff Sergeant, complete one year of OJT, as well as management course. The 7 level is an Optometry Technician, the highest technical skill level you can achieve. Progression to the 9 level is directed towards management of a number of clinics and is consequently called Clinic Superintendent.

CAREER PROGRESSION OUTLINE

AFSC 912X5

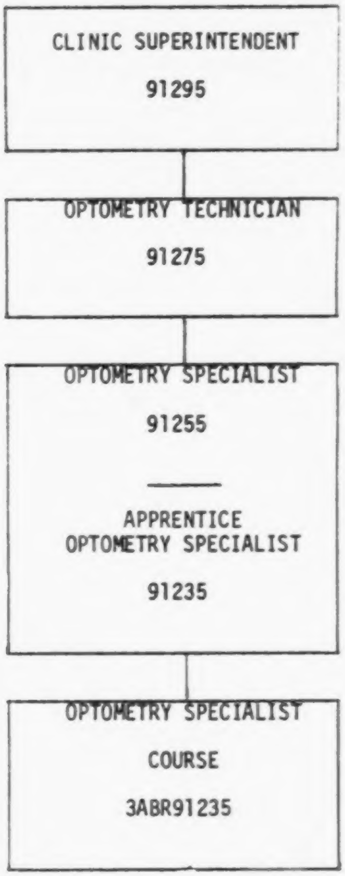

CLINIC SUPERINTENDENT
91295
OPTOMETRY TECHNICIAN
91275
OPTOMETRY SPECIALIST
91255
APPRENTICE OPTOMETRY SPECIALIST
91235
OPTOMETRY SPECIALIST COURSE
3ABR91235

Figure 1-1

Vision Care Specialists

Your field is concerned with "eye Care." You should know the names of the various personnel who contribute to the overall term "eye care," and what their specific area of concern is. There are three major eye fields: Ophthalmology optometry, and Opticianry.

The ophthalmologist is the practitioner concerned with the medical and surgical care of the eye and its appendages. They are M.Ds. who have taken a 3-4 year residency in diseases and surgery of the eye. Their training also includes refraction and the fitting of contact lenses.

The optometrist is the practitioner concerned with vision and visual care. Optometrists(O.Ds) have at least two years of college and four years of optometry school. Training is directed towards the diagnosis and treatment of visual errors of the healthy eye, but also includes detection of pathologic conditions. The O.D. is not trained to perform surgery.

The optometry specialist career field (AFSC 91235) is relatively new, having begun in 1971. It is a small field designed to support approximately 200 Air Force Optometrists. Prior to 1971, the eye clinics were staffed by anybody the optometrist could "scrounge," usually a medical corpsman on loan from somewhere else in the hospital. Their optometry training was on-the-job training only, and often after they became proficient, the loaning agency would grab them back. This is the primary reason for the formation of the career field - to provide permanent, well trained people to assist the optometrist with patient backlogs in Air Force eye clinics.

AFR 39-1 gives a general description of your duties. Your clinic duties will be to assist the optometrists in: examination and treatment of patients, preparation and fitting spectacles, fitting contact lenses, and visual training. In some clinics with large backlogs, you will probably be performing visual screenings - that is putting the patient through a series of tests to determine whether or not they need a complete examination. That way the optometrist only sees patients with visual problems instead of using his time on people who may not need a full eye exam.

The optician is involved with the design and manufacture of ophthalmic lenses. They grind the lenses, put them in frames, and make sure the glasses fit properly.

Frequently Called Telephone Numbers

To call Sheppard from off base, dial 851 and then the base number.

Airmen's Club	6828
Base Housing and Billeting	2707
Base Information	4111
Base Locator	4403
CBPO (Career Information)	4314
Department of Biomedical Sciences	6410/6232
Finance (Pay Inquiries)	4323
Headquarters Section	2166
Hospital Appointments	4585
Hospital Emergency	2333
Mental Health Clinic	6358
NCO Club	6427
Officer's Club	6460
Pass and Identification	6875
SHCS Duty Officer (after duty)	2737
Security Police	6302
Vehicle Registration	6875
Optometry Instructors	6410/6232

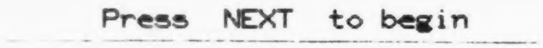
INTRODUCTION TO PLATO

PLATO IV is a computer assisted instruction (CAI) system. All the study material for Blocks 1 and 5 is on PLATO and you may be scheduled to complete these blocks on the computer. The schedule is designed so you will spend part of your time on PLATO and part of your time in the classroom. The classroom hours will give you a chance to ask questions about PLATO lessons and review the material you have covered.

Since most students have not used a computer, let's briefly discuss how to sign-on. PLATO already knows your name and is waiting for you.

Each PLATO terminal has a display screen and a keyboard. Press the right keys on the keyboard and you can make lessons appear on the screen.

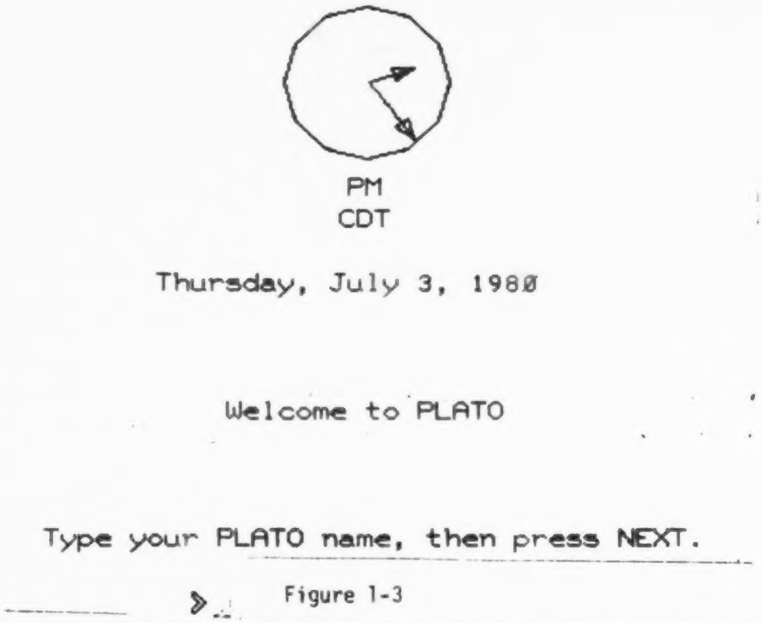
When you first sit down at your terminal, the screen may be blank or you may see:



Press NEXT to begin

Figure 1-2

or you may see this.



PM
CDT

Thursday, July 3, 1980

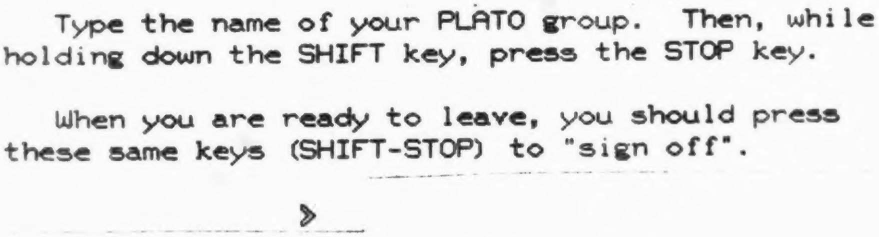
Welcome to PLATO

Type your PLATO name, then press NEXT.

Figure 1-3

To start your sign-on, keep pressing the NEXT key (the gray one with NEXT written on it) until you see Figure 1-3 displayed on your screen, type your last name, and press NEXT. Be sure you spell your name right. PLATO gets upset with people who can't spell their name.

This is the next display you will see.

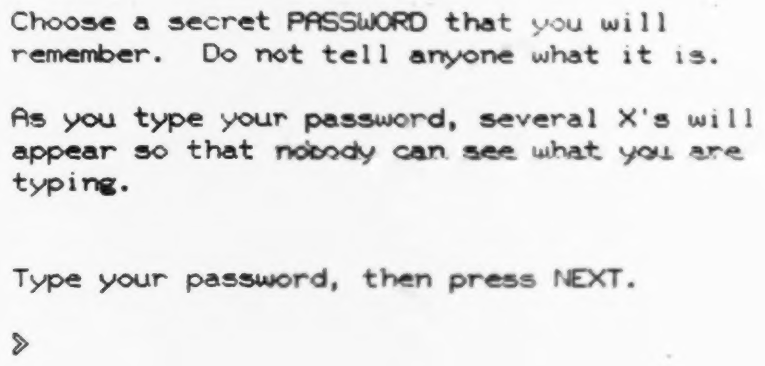


Type the name of your PLATO group. Then, while holding down the SHIFT key, press the STOP key.

When you are ready to leave, you should press these same keys (SHIFT-STOP) to "sign off".

Figure 1-4

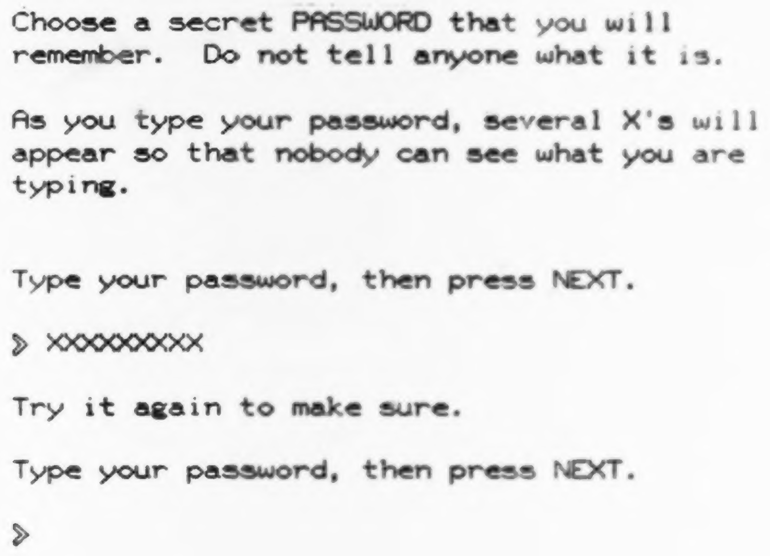
Your PLATO group is shpg. Type shpg, press the SHIFT and STOP keys (both at the same time), and you should see this display on your screen.



```
Choose a secret PASSWORD that you will
remember.  Do not tell anyone what it is.

As you type your password, several X's will
appear so that nobody can see what you are
typing.


Type your password, then press NEXT.

>
```

Figure 1-5

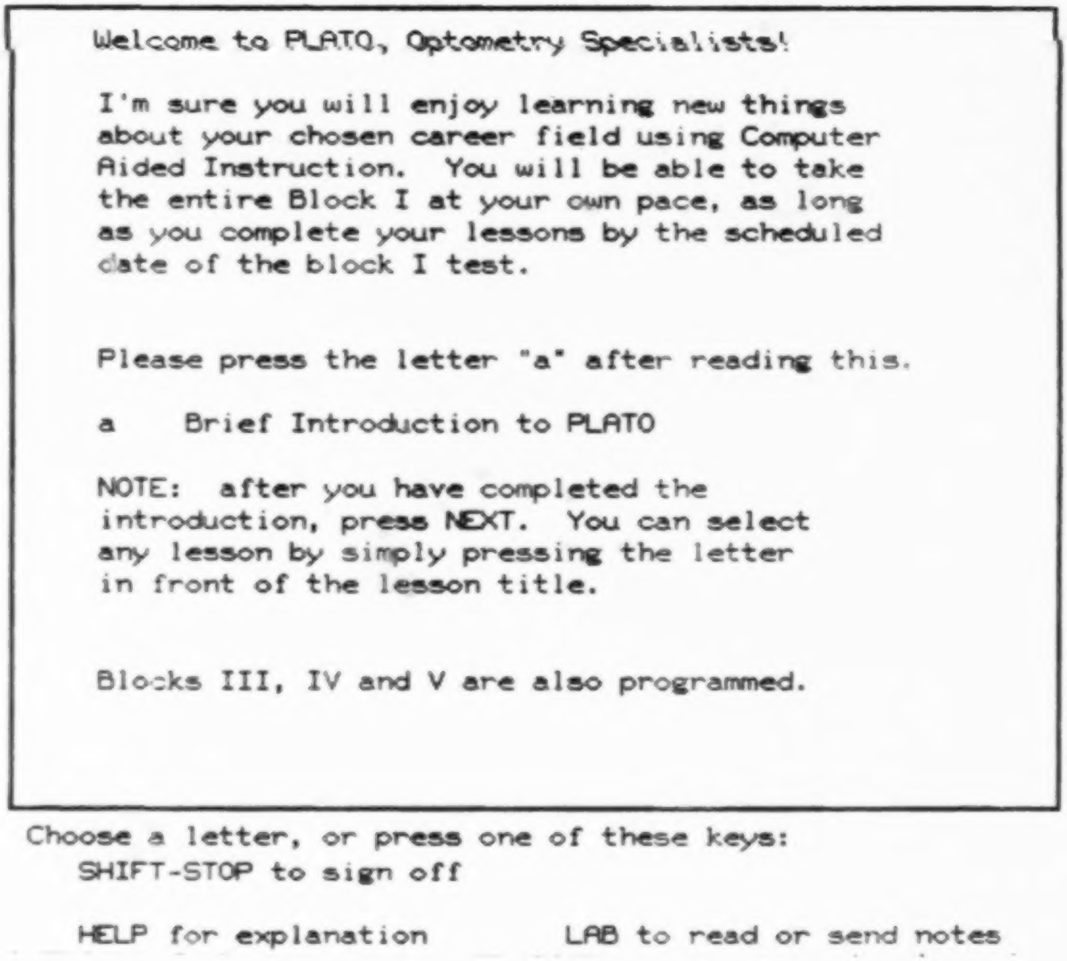
Read the instructions on selecting a password, type your password, and press NEXT.



```
Choose a secret PASSWORD that you will
remember.  Do not tell anyone what it is.

As you type your password, several X's will
appear so that nobody can see what you are
typing.


Type your password, then press NEXT.

> XXXXXXXXX

Try it again to make sure.

Type your password, then press NEXT.

>
```

Figure 1-6

Type your password again and remember it. PLATO won't let you sign-on without your password in the future. Press NEXT and you should see this on your screen.



```
Welcome to PLATO, Optometry Specialists!

I'm sure you will enjoy learning new things
about your chosen career field using Computer
Aided Instruction.  You will be able to take
the entire Block I at your own pace, as long
as you complete your lessons by the scheduled
date of the block I test.


Please press the letter "a" after reading this.

a    Brief Introduction to PLATO

NOTE:  after you have completed the
introduction, press NEXT.  You can select
any lesson by simply pressing the letter
in front of the lesson title.


Blocks III, IV and V are also programmed.

Choose a letter, or press one of these keys:
   SHIFT-STOP to sign off

   HELP for explanation        LAB to read or send notes
```

Figure 1-7

Now you can start your lessons. From here on follow PLATO's instructions. Should you have any problems just ask your instructor for help.

Department of Biomedical Sciences
School of Health Care Sciences, USAF
Sheppard Air Force Base, Texas 76311

SW J3ABR91235 000-I-2

INTRODUCTION TO THE OPTOMETRY CAREER FIELD

OBJECTIVES

This Study Guide and Workbook (SW) is designed to give you fundamental knowledge in the following areas:

a. Mission, organization, development, and function of the Medical Service and Optometry Clinic.

b. Career Ladder progression, duties, and educational opportunities of AFSC 912X5.

c. Principles of General Safety.

d. Professional relationships.

INFORMATION

MISSION, ORGANIZATION DEVELOPMENT AND FUNCTION OF THE MEDICAL SERVICE AND OPTOMETRY CLINIC

OBJECTIVE

Given WS J3ABR91235-000-1-2a. Identify facts pertaining to the USAF Medical Service with 70% accuracy.

Mission

The mission of the Air Force Medical Service is to provide the medical support necessary to maintain the highest degree of combat readiness and effectiveness and to provide medical support to all eligible personnel.

Organization

The top medical person in the Air Force is the Surgeon General. The Surgeon General advises the Chief of Staff, USAF, on medical matters and is responsible for the overall management of the USAF Medical Services. Each Major Air Command (ATC, TAC, SAC, etc.) has a Command Surgeon who supervises all medical services within the command and advises the Surgeon General on the status of medical functions within the Command.

The Director of Base Medical Services (DBMS), more commonly known as the Hospital Commander, supervises medical facilities at an Air Force Base. The DBMS advises the Command Surgeon and Base Commander on matters pertaining to medical care at the local level.

Development

The development of the Air Force Medical Service can be traced back to the beginning of our nation. During the American Revolution, there was no central organization for military medical services. Each regiment took care of its own medical affairs, many times at the expense of the wounded. Of the 1,200 physicians who served during the Revolutionary War, only 100 had medical degrees. Congress created the U.S. Military Medical Service in 1775 upon General Washington's recommendation.

In 1818 Congress reorganized the medical service. Dr. Joseph Lovell was appointed Surgeon General, and professional examination became a requirement for entry into the Medical Corps. By the late 1800's, men were being trained to provide paramedical assistance to physicians, and the importance of military medicine was finally recognized.

The introduction of the airplane as a weapons system brought about two important changes. Prior to WW I, very little was known about the effects of flight on the human body. As WW I progressed, these effects became obvious. The Allied Forces lost more aircraft and pilots because of human physical defects than were lost in combat. The Army Medical Corps was ordered to establish physical standards for flight duties, and a new branch of military medicine, Aviation Medicine, was born.

With the advent of Aviation Medicine, medical authorities determined that the wounded personnel could be evacuated by air. Although used only to a limited degree in WW I, air evacuation evolved as one of the most effective ways of moving wounded in WW II. At the end of the war over one million sick and wounded had been transported. Aviation medicine was well established, and the corner stones were laid for the future Air Force Medical Service.

As more sophisticated aircraft were developed and human physiology in flight became more complicated, medical authorities began to see the need for a medical service whose primary mission would be to deal with the rapidly expanding field of Aviation Medicine. Finally, on 1 July 1949, the USAF Medical Service was established, Maj Gen Malcolm Grow was appointed the first Surgeon General, and Aviation Medicine was prepared for its final step, Space Age Medicine.

The USAF Medical Service, in the 60's and 70's was instrumental not only in developing new methods for treating battle casualties, but also the development of many devices, originally intended for use during space flight. Portable cardiac pacemakers and artificial limbs are just two examples of space age medical technology that now benefits the entire population.

Function

The USAF Medical Service has three primary functions. The first is selection of people who are physically and psychologically capable of performing combat duties. Professional military physicians establish the standards for selection.

The second function is prevention of illness and injury. In order to maintain a combat-ready force, a vast amount of attention is given to the preventive function of the AF Medical Service. Environmental Health Technicians continually monitor our environment - food, housing, sanitation, and hazardous work areas to insure the health and welfare of Air Force personnel.

The third function is that of rehabilitation. Although great effort is expended to prevent injury or illness, the Air Force is made up of people. People get hurt, people get sick, and people sustain injuries in combat. The purpose of rehabilitation is to cure the sick or injured airmen and return them to duty as quickly as possible.

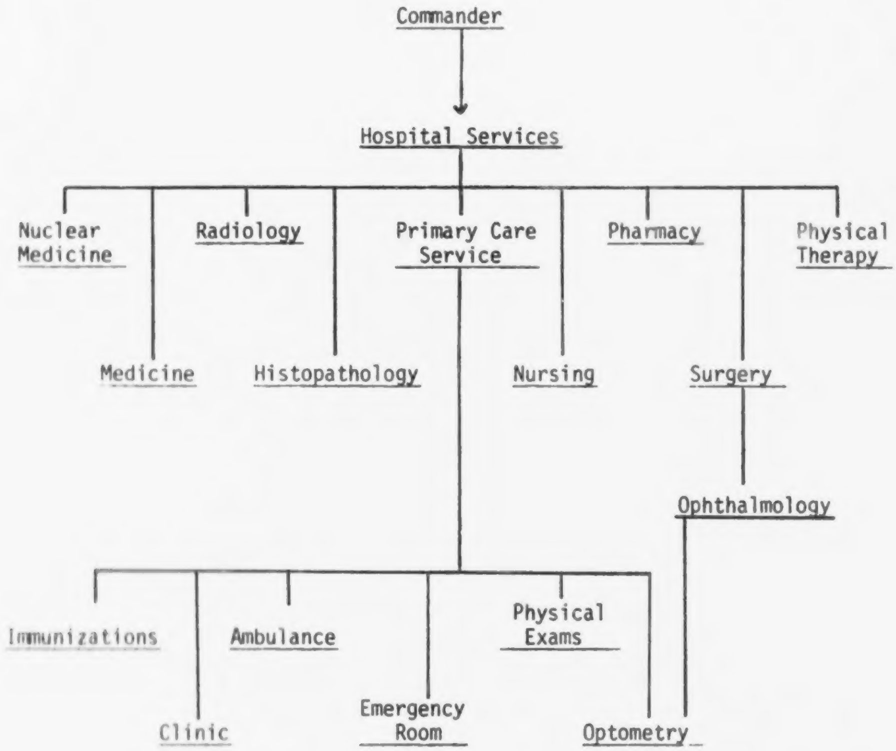

Commander
Hospital Services
Nuclear Medicine
Radiology
Primary Care Service
Pharmacy
Physical Therapy
Medicine
Histopathology
Nursing
Surgery
Ophthalmology
Immunizations
Ambulance
Physical Exams
Clinic
Emergency Room
Optometry

Figure 2-1

THE OPTOMETRY CLINIC

Mission

The mission of the Optometry Clinic is to support the mission of the AF Medical Service by providing quality eye care for active military forces and eligible personnel.

Organization

Hospital and optometry clinic organizational charts have undergone several revisions in the past years. At one time, the "eye clinic" was staffed entirely by enlisted personnel and usually affiliated with the Flight Surgeon's Office. Until a few years ago, the optometry clinic could be under the authority of either the flight surgeon, ophthalmology, department of profession services, Air Force Clinics, EENT Clinic, or under the general heading of "outpatient care clinics."

At the present time, AFM 168-4 states that the optometry clinic will be under the Chief of Ophthalmology. If no ophthalmologist is assigned, then optometry falls under the Chief of Primary Care. (See Figure 2-1.)

Development

During WW II optometrists were not commissioned; they served as enlisted personnel under the direct supervision of an ophthalmologist. Following the war physicians and enlisted personnel (non-OD's) provided limited eye care. Finally, in June 1949 the first optometrists were commissioned as 2nd Lt's in the Medical Service Corps. The era from 1950-1965 saw many improvements in eye care and in the quality and type of equipment available to the AF optometrist. In 1965 the authorized strength of optometrists reached 160 and in March of that year, the Biomedical Science Corps (BSC) was established and all optometrists became BSC officers.

Prior to 1 Oct 71, AF optometrists were "assisted" by what you might call a general medical corpsman-an individual loaned to the O.D. for an indefinite period of time. These individuals were usually either discharged from the military or moved to other duties as soon as they learned enough to be helpful.

On 1 Jan 1971 a new AFSC was established - 912X5, Optometry Specialist/Technician. The first 3ABR91235 class, consisting of 12 students, entered training on 7 July 1971 and graduated on 1 Oct 1971, and on that date, many "old timers" who were working in Optometry Clinics were awarded the 912X5 AFSC. The AF O.D. finally had a trained assistant not subject to duties in other clinics. There are now approximately 204 912X5's who assist Air Force optometrists by relieving the O.D. of as many of the nonprofessional duties as possible.

Function

The function of the Optometry Clinic is to support the mission of the hospital. The mission of the USAF Hospital is to provide the medical support necessary to maintain the highest degree of combat readiness and effectiveness of the USAF personnel and all other eligible personnel. The optometry clinic is responsible for the prevention, detection, treatment, and referral of eye problems.

PREVENTION. Prevention may consist of inspection of possible eye hazardous areas, the prescribing of appropriate safety devices, or writing articles on preventative eye care.

DETECTION. Detection of vision abnormalities, while still in their early stages, is accomplished by vision surveys conducted in local schools or in the clinic as part of the routine eye examination. There are certain vision abnormalities, usually occurring in children, where early detection may mean a noticeable difference in their ability to use their eyes properly. As approximately 80% of what we learn comes to us through our eyes, early detection could have a definite bearing on the child's life. Early detection of vision problems also insures the readiness of our active duty force.

TREATMENT. Treatment of vision problems is one of the largest areas of responsibility in the optometry clinic. Although the prescribed treatment usually consists of spectacles, it may also include contact lenses or orthoptics (visual training).

REFERRAL. Often times, diseases of other parts of the body, besides the eye, will be picked up first in the eye examination. Medical, surgical, or psychiatric treatment from the appropriate clinic may be required.

EXERCISE 1-2a

INSTRUCTIONS

Complete the following statements concerning the mission of the USAF Medical Service and Optometry Clinic.

1. The mission of the Air Force Medical Service is to ______________________________

____

____.

2. The top medical person in the Air Force is the ______________________________.

3. The ______________________ supervises all medical services within a command.

4. ______________________ was the first USAF Surgeon General.

5. The 3 functions of the USAF Medical Service are ________________, ________________, and ______________________.

6. The mission of the Optometry Clinic is to ______________________________

____

7. The Optometry Clinic is responsible for the ______________________, ______________

______________________, ______________________, or ______________ of eye problems.

8. The prescribed treatment in an eye clinic usually consists of ______________________.

CAREER LADDER PROGRESSION

OBJECTIVE

Given WS J3ABR91235 000-I-2b, Identify career progression within the 912X5 career field with 70% accuracy.

Career Ladder Progression

You will graduate this course with a 3-level and train to the 5 skill-level at your next base. Training consists of a Career Development Course (CDC) from the Extension Course Institute (ECI) and on-the-job training (OJT) in the clinic. Unon successful completion of the above and the recommendation of your supervisor, you will be awarded the 5 skill level.

You enter 7-level training after promotion to Staff Sergeant. The 7-level is awarded after completing an accepted management course, one year OJT, and your supervisor's recommendation.

If you stick around and make Master Sergeant, you will then be eligible to train to the 9-level, Clinic Superintendent.

Duties of AFSC 912X5

AFR 39-1 gives a description of the duties of each AFSC. Duties are then further broken down in the Specialty Training Standard(STS) previously mentioned. The STS is used at the school to determine what skills you will be taught at the 3-level, and to what degree of complexity you will be trained to. The clinics use the STS as a Job Qualification Standard (JQS), for on-the-job training.

The duties performed by all Optometry Specialists regardless of skill level are similiar. The 3 and 5 level specialists will generally perform the following:

- Assists in examination and treatment of patients
- Assists in preparation and fitting of spectacles
- Assists in fitting contact lenses
- Performs visual screenings
- Assists in visual training

The 7 and 9 level technicians will perform many of the same duties, in addition to the following:

- Supervises clinic personnel
- Prepares duty rosters
- Assigns training to newly assigned/promoted personnel
- Performs more technical ancillary procedures

Educational Opportunities

The Community College of the Air Force is a unique occupational education institution designed specifically for the enlisted men and women of the United States Air Force. The college offers the opportunity to broaden your education and attain higher skill levels as an Optometry Specialist. The program is open to all USAF Regular, Reserve, and ANG personnel who complete this course. Sixty-four semester hours are required to receive an AAS degree in Optometric Technology. These hours are broken down into Technical Education and Core Curriculum. That thirty hours of Technical Education consists of the Optometry Specialist Course, Upgrade Training, and elective courses.

The thirty-four hours of Core Curriculum includes General Education, with some required subjects, Management Education, and Physical Education. The required subjects under General Education are Algebra, Biology, History and Psychology. Off duty education is strongly encouraged.

In many cases, people have obtained proficiency in a subject without receiving college credit. CLEP and DANTES examinations may be taken to receive college credit in these areas.

For those individuals who are within one year of their bachelors degree, the Bootstrap program is ideal. It allows peope to go TDY (Temporary Duty Assignment), with full pay and allowances, to complete their degree. The individuals must be released by their supervisor and have Major Command approval.

The Airmen's Education and Commissioning Program is another way to finish your degree and become a commissioned officer. To be eligible for this program, you must be within two(2) years of your degree, studying a scientific or technical area, and have (1) year of calculus.

For further information on these educational opportunities, see your Base Education Office.

Exercise 1-2b

INSTRUCTIONS

Complete the following statements concerning career ladder progression in the Optometry career field.

1. 5 skill level training for the 912X5 field consists of a ____________________ course and ____________________ training.
2. Management training and one year of OJT are requirements for upgrade to the ____________ level.
3. Optometry clinics use the STS as a ______________________________.
4. ____________ hours are required for the CCAF degree in Optometric Technology.
5. ______________ and ______________ examinations may be taken to receive college credit.

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PRINCIPLES OF GENERAL SAFETY

OBJECTIVE

Given WS J3ABR91235 000-I-2c, select statements that relate to general safety with 70% accuracy.

General Safety

During the past several days you have been subjected to numerous safety lectures and briefings. Safety and accident prevention should be uppermost in your mind from the day you enter your clinic until the day you leave. As in many areas, COMMOM SENSE should be the rule in regard to safety.

Conduct a brief safety inspection every morning. Ask yourself these questions:

1. Are all electric cords fully visible and in good condition?
2. Are there any tears or rips in the carpet that could cause a person to trip and be injured?
3. Are all desks and tables clear of any clutter that could cause safety problems?
4. Are all lights in working order so as not to cause a safety hazard to anyone walking into the clinic?
5. When leaving the clinic at the end of the day, again conduct a short safety inspection.

1. Are all ash trays and trash cans empty and the trash properly disposed of?
2. Are all electrical instruments and equipment unplugged and properly placed in storage?
3. Is all office furniture arranged to preclude possible injury should someone enter the clinic?

As you know accidents don't just happen. There is a reason for every accident that occurs. There are several factors that contribute to any accident. Think of the last accident you witnessed in the dorm, at home, or on your last job. At least one of the factors below was present and caused the accident.

1. Haste
2. Horseplay
3. Failure to secure
4. Incorrect use of tools
5. Incorrect use of medication
6. Poor posture position
7. Use of short cuts
8. Wrong type of dress for the job
9. Poor lighting or ventilation

You could list many more factors that do contribute to any accident.. Take a few minutes to think about it.

Since we know that accidents are caused by unsafe acts and conditions, you must agree that most accidents can be prevented. One way is by an active Safety Education Program. When hazards are found, brief other clinical personnel. Also don't assume that new personnel are going to be familiar with hazards on the job. AFOSH briefings are designed to brief new personnel on these hazards. Your supervisor should brief your regularly. Also, before leaves, TDYs, and even long weekends, safety briefings are essential.

Accident Reporting

Should the unavoidable happen and someone is injured in your clinic, accident reporting procedures can be found in AFR 127-4 and local supplements. AF Form 711a is used for reporting accidents, unless local forms are used. Upon arrival at your new clinic, the OIC or NCOIC will brief you on local procedures for accident reporting.

All accidents are preventable, take the proper precautions.

There is a tendency for people to forget to enter information into the Medical Record in the confusion of an accidental injury. Complete records are necessary for the protection of the patient, the U.S. Government, and the personnel concerned.

If the Medical Record is not available, be sure to accomplish a blank SF 600 for later insertion into the record. Entries should include:

1. Name and SSAN of patient.
2. A detailed description of the accident (how it happened and when).
3. A description of the injury sustained.
4. A detailed breakdown of treatment or first aid rendered.
5. Disposition of the patient.
6. The signature of the person rendering treatment.

NOTE: Remember - "The job's not done until the paperwork is finished."

EXERCISE 1-2C

INSTRUCTIONS

Complete the following statements concerning safety and accident reporting.

1. ____________________ should be the rule in regard to safety.

2. Accidents are caused by unsafe ______________________ and __________________________.

3. _____________________________ briefings are designed to brief new personnel on hazards of the job.

4. Unless a local form is used, ___________________________ is used to report accidents.

5. Complete records are necessary in accident cases for protection of ___________________,

________________________, and ____.

MAINTENANCE OF MEDICAL RECORDS

OBJECTIVE

Given WS J3ABR91235 000-i-2d, select the proper placement of listed forms in a medical record with 70% accuracy.

Forms Used in a Medical Record

Everyday you will come into contact with countless numbers of medical records and associated forms. Every bit of information concerning patients must be filed to keep their medical history complete. It helps when searching for information that you know where to look. This saves time and prevents overlooking important facts.

The most frequently used form is the SF 600, Chronological Record of Medical Care. This form is just that, a record of all visits and treatments rendered in chronological order. Quite a few optometrists use this form for their exams, either in the blank format, or with an overprinted list of tests. Because this is the main form used, it's on the right side of the record on top of all other forms.

The SF 513 is also found on the right side of the folder. This form is used to refer patients to other specialties.

The left side contains miscellaneous forms. The SF 88, the AF 422 to report physical profile changes, the Privacy Act Form, Spectacle Order Form DD 771, Visual Field Examination Forms, and the DD Form 741 used by many optometrists are among those found on the left side of the folder.

The outside of the record should include allergies and other pertinent information that would warn of a serious condition or special duty.

Records are filed by the patient's or sponsor's social security number, and are color coded by the last two digits to facilitate location. Safeguarding patient's records is a must and the responsibility of all hospital personnel.

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EXERCISE 1-2d

INSTRUCTIONS

Complete the following statements concerning maintenance of medical records.

1. The most frequently used form in a record is the ______________________.
2. The ______________________ is used to refer patients to other specialties.
3. Records are filed by the patient's or sponsor's ______________________ number.
4. Locations of records is facilitated by use of ________________ code.

PROFESSIONAL PATIENT RELATIONSHIPS

OBJECTIVE

Given WS J3ABR91235 000-1-2e, describe the steps necessary for a professional relationship with 70% accuracy.

Ethics and Professional Standards of Conduct

Ethics are defined as a set of rules or standards governing the members of a profession. As paraprofessionals, you are expected to maintain certain standards in the performance of your duties. Always treat patients courteously and with respect, actively promote good professional relations with the medical staff, and be concerned for the patient's psychological as well as optometric needs.

Patients don't know what will happen to them in an optometry clinic and may need some reassurance. A relaxed patient will give more accurate results than a nervous and worried one. Give the patient clear instructions, whether directions to another department or instructions for a procedure or test. They are in a strange environment; be pleasant and set the patient at ease.

At no time are you at liberty to discuss anything that pertains to a patient or the patient's medical record, unless it is with an authorized person WITH A NEED TO KNOW. Anything a patient tells you must be held in strictest confidence, or the patient will lose faith in your clinic and Air Force Medicine in general.

Some good rules to remember are:

1. In all of your professional contacts, be honest and loyal and serve to the best of your ability.
2. Hold in strictest confidence the details of the professional service rendered by your doctor.
3. Do not provide any service that you're not specially trained and authorized to perform.
4. Make no derogatory remarks which would imply that a staff member has not provided the best treatment possible.
5. Make no derogatory remarks about the profession of Optometry.
6. Realize your obligation to continue your education, and avail yourself of all educational opportunities.

PATIENT DATA CONFIDENTIALITY

You have a moral and legal responsibility to protect the patient's confidentiality. Your patient's medical records contain numerous juicy tidbits of information - information that will really hold the attention of your buddies at the club, your friends at parties, or your spouse or friend over dinner. However, the information Mrs. Jetstream's and Captain Crash's medical records is confidential, and you can be held responsible for invasion of privacy if you discuss that information at the wrong place and and at the wrong time. There is no privileged communication statute in the military, which means that you, your doctor, and all other medical personnel may be compelled to divulge information about a patient in a military court. This still does not relieve you of the legal and ethical responsibility to hold all oral and/or written information in strict confidence. Patient information should only be discussed with other medical personnel with a need to know.

Conflict of interest

Many service members use the skills learned in the Air Force for off-duty employment. As a general rule, the Air Force has no objection to this practice. However, certain guidelines exist defining "ethical conduct"; these guidelines are based upon federal statutes.

The most important AF regulations are AFR 30-30 and AFR 211-16. Every AF member engaged in off-duty employment -- whether working for himself/herself or someone else -- has an obligation to thoroughly understand these directives and the prohibitions they contain.

When questions arise, the local Staff Judge Advocate's Office should be consulted. Misinterpretation or faulty application of the regulations is not an acceptable excuse for violating them.

The guidelines are simple and quite logical. Your off-duty job cannot interfere with your AF position, and you cannot do anything on duty that would further your private business interests. You cannot solicit customers, advertise, gather names, or drop subtle hints that you have private goods or services to offer. The regulation also prohibits the appearance of impropriety.

There are a number of particularly troublesome areas. For instance, anytime you deal off-duty with subordinates, problems can and will arise. Oftentimes persons in supervisory capacities will be asked informally where to buy a car, a home, or secure various services. Even if the supervisor can give the on asking a good deal, this would constitute unlawful solicitation. Gathering and selling lists of names of military members and their families to downtown business is also strictly forbidden. Although, casual one-time sales of personal property, such as a car, a boat, sofa, clothing, etc., can be done safely between AF members.

A special problem arises with military members providing a professional service. This includes doctors, lawyers, dentists, and optometrists, to name only a few. Many of these persons will work off-duty. The rule-of-thumb is that an AF doctor or lawyer, for example, cannot charge off-duty what he/she could do on duty. Another good example is the optometrist or assistant who offers to "sell on the side" contact lenses which the Air Force will not make available. Referring patients to a specific practioner downtown is also prohibited.

As an Optometry Specialist, you may be asked by patients where to get their spectacle prescriptions filled. You should try not to "steer" them to a particular civilian optical shop (the BX Optical Shop included), but suggest that any civilian optical shop is as good as any other. You could possibly name three or four different ones in the area frequented by most people.

EXERCISE 1-2e

INSTRUCTIONS

Complete the statements concerning professional patient relationships.

1. The standards that govern the conduct of professionals are called ____________________.

2. You must be concerned about each patients' optmetric and ____________________needs.

3. Never discuss a patient's medical record unless it is with an authorized person with________________

____________________________________.

4. The most important regulations dealing with conflict of interest are ____________________________

and ______________________________.

5. When on duty you cannot ______________________, ______________________, ________________,

or______________________that you have private goods or services to offer.

Department of Biomedical Sciences
School of Health Care Sciences, USAF
Sheppard Air Force Base, Texas 76311

GEOMETRICAL OPTICS

OBJECTIVES

Upon completion of this Study Guide/Workbook (SW), you will be able to:

a. Identify principles of geometrical optics.

b. Solve optometric math problems.

INFORMATION

THEORIES OF LIGHT PROPAGATION

OBJECTIVE

Given WS J3ABR91235 000-I-3a identify principles of geometrical optics with 70% accuracy.

LIGHT AND LIGHT WAVES

The bold fact is that no one really knows what light actually is. In this section, we will give you some working definitions of light, as well as some light theories to try and give you some understanding of light.

Defining Light

There are two definitions of light that we should be familiar with - a technical and a clinical definition. The clinical definition is the one we will use in this course.

Technical: a form of radiant energy which stimulates the receptor cells of our eyes so as to cause the sensation of vision.

Clinical: light is that which we see by.

Thus in this course we don't regard electromagnetic radiation outside of the visible spectrum as light because we cannot see by it.

Theories of Light Propagation

There are three theories of light propagation: Wave theory, particle theory, and electromagnetic wave theory.

1. The wave theory states that light travels as energy along waves.

This theory was first proposed by Huygens and later supported by Young, Fresnell, and others.

To illustrate the concept of the wave theory, imagine that you have secured one end of a rope to some object and are holding the other end in your hand. Now stretch the rope fairly tight and shake it. The wave motion passes along the rope from the end you are holding to the secured end. If you continue to shake the rope, you create a series of waves (a wave train).

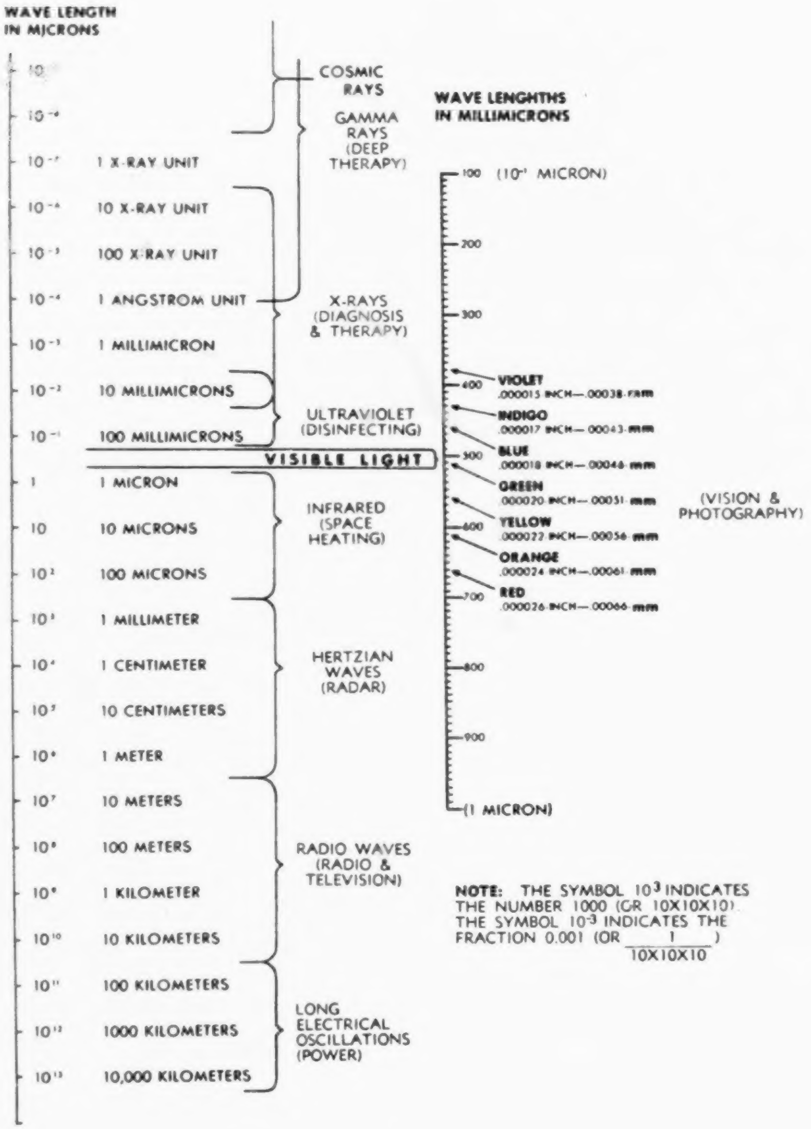
Imagine now that a light source is a vibrating ball from which a countless number of threads extend in all directions. As the ball vibrates, successive waves are transmitted along the threads. Light radiates from its source in a similar manner.

2. The particle theory states that light is composed of high speed particles emmitted in all directions from a luminous body.

This idea was first introduced by Sir Issac Newton as his corpuscular theory and later expanded by Planck in his Quantum Theory which Albert Einstein supported a few years later.

3. The electromagnetic wave theory is an extrapolation of the wave theory and records light as a combination of electric and magnetic forces.

This theory was first proposed by Maxwell and is now accepted by most modern day scientists. Heat, radiowaves, light rays, ultra-violet and infrared rays, X-rays and cosmic rays are all forms of radiant energy of different wavelengths and frequencies. Together, all of these form the electromagnetic spectrum, illustrated in Figure 3-1. As you can see, the visible portion of the electromagnetic spectrum is very small and consists only of wavelengths between about 400 and 700 milimicrons. The different wavelengths within this range correspond to different colors of light.


WAVE LENGTH IN MICRONS
10
10^{-8}
10^{-7} 1 X-RAY UNIT
10^{-6} 10 X-RAY UNIT
10^{-5} 100 X-RAY UNIT
10^{-4} 1 ANGSTROM UNIT
10^{-3} 1 MILLIMICRON
10^{-2} 10 MILLIMICRONS
10^{-1} 100 MILLIMICRONS
VISIBLE LIGHT
1 1 MICRON
10 10 MICRONS
10^{2} 100 MICRONS
10^{3} 1 MILLIMETER
10^{4} 1 CENTIMETER
10^{5} 10 CENTIMETERS
10^{6} 1 METER
10^{7} 10 METERS
10^{8} 100 METERS
10^{9} 1 KILOMETER
10^{10} 10 KILOMETERS
10^{11} 100 KILOMETERS
10^{12} 1000 KILOMETERS
10^{13} 10,000 KILOMETERS
COSMIC RAYS
GAMMA RAYS (DEEP THERAPY)
X-RAYS (DIAGNOSIS & THERAPY)
ULTRAVIOLET (DISINFECTING)
INFRARED (SPACE HEATING)
HERTZIAN WAVES (RADAR)
RADIO WAVES (RADIO & TELEVISION)
LONG ELECTRICAL OSCILLATIONS (POWER)
WAVE LENGTHS IN MILLIMICRONS
100 (10^{-1} MICRON)
200
300
400
500
600
700
800
900
(1 MICRON)
VIOLET .000015 INCH—.00038 mm
INDIGO .000017 INCH—.00043 mm
BLUE .000018 INCH—.00046 mm
GREEN .000020 INCH—.00051 mm
YELLOW .000022 INCH—.00056 mm
ORANGE .000024 INCH—.00061 mm
RED .000026 INCH—.00066 mm
(VISION & PHOTOGRAPHY)

NOTE: THE SYMBOL 10^{3} INDICATES THE NUMBER 1000 (OR 10X10X10). THE SYMBOL 10^{-3} INDICATES THE FRACTION 0.001 (OR $\frac{1}{10X10X10}$)

Figure 3-1

BEST COPY AVAILABLE

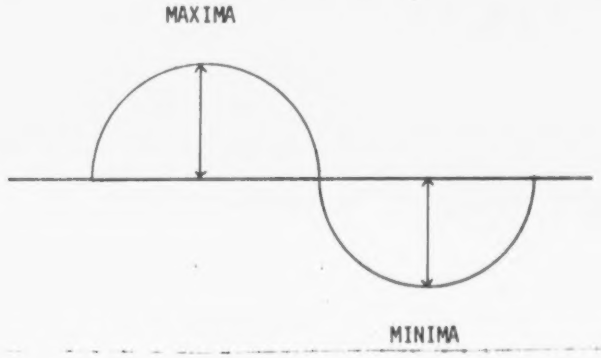
Usage Of Light Theories

For the sake of simplicity and ease of understanding, we will use the particle theory to explain emission and absorption of light. Emission is the giving off of light energy (a light bulb, candle or other luminous body) and absorption is the taking in of light energy and converting it to another energy form, usually heat. A car sitting out in the sun reflects the characteristic color of the car and absorbs all the rest of the rays converting them to heat energy.

Much of this course will deal with the effects of lenses on light, primarily transmission of light energy. The wave theory will be used to explain transmission of light through any medium; air, water, lenses or any other optical device, including the eye.

Both of the theories we will use agree on one subject - light travels in straight lines. This was shown by a study of shadows made by the ancient Greeks and has become known as Rectilinear Propagation of Light. It simply says that light travels in straight lines through a constant medium.

WAVELENGTH, AMPLITUDE, FREQUENCY AND VELOCITY OF LIGHT WAVES. Before getting into any definitions or explanations, it is always best to get the terminology straight. If you throw a rock into a pool of water, you will get waves. The CREST is the top of the wave and the TROUGH is the bottom. These may also be called MAXIMA (crests) and MINIMA (troughs), the terms may be used interchangeably. One complete waveform is called a CYCLE and is illustrated in Figure 3-2.



One Complete Cycle

Figure 3-2

If you remember the waves in the water analogy, you shouldn't have any trouble with light waves.

A WAVELENGTH (Lambda) is the distance between any point on a wave to the same point on an adjacent wave. Figure 3-3 shows different ways of measuring wavelength.

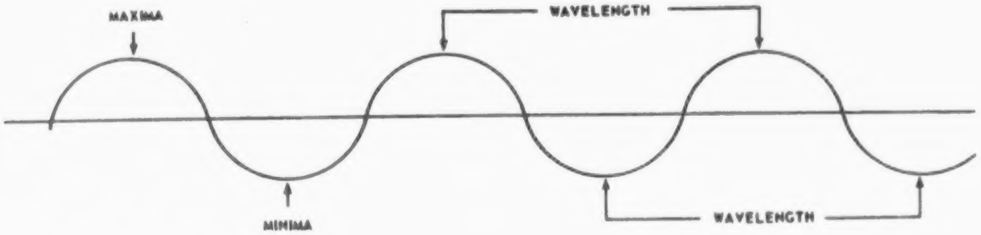


Figure 3-3

The use of modern and precise methods, based on interference and diffraction, has enabled scientists to measure light wavelengths with great accuracy.

Amplitude and Brightness Relationship

Amplitude is the maximum displacement of the waveform. Figure 3-4 shows the amplitude of a waveform.

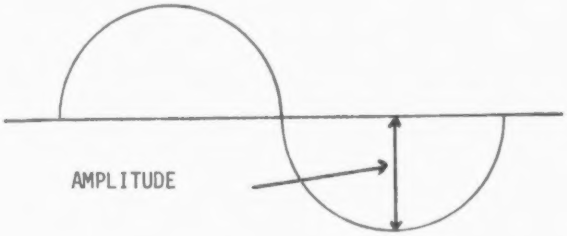


Figure 3-4

The greater the amplitude of a light wave, the brighter the light will appear to be. In other words, if two lights of the same color are side by side and one is brighter than the other, the brighter light is brighter because it is of greater amplitude than the dimmer light.

Frequency

Frequency is the number of waveforms(cycles) that pass a given reference point in a measured amount of time, usually one second.

If one were to put a stake in our pool of water as a reference point, and then count the number of crests passing that stake in a given unit of time, this would give us the frequency. Let us say that 40 crests (each one representing a complete cycle) pass the stake in a 10 second time frame. Frequency may be expressed as below:

$$\frac{40\ \text{cycles}}{10\ \text{seconds}} = 4\ \text{cycles/second}$$

Light frequencies are measured in much the same fashion, but bear in mind that frequency depends upon the wavelength and velocity of the wave.

Velocity of Light

Because light travels at such high velocity, it was years before anyone could measure its speed.

Modern physicists compute the speed of light with great accuracy - the speed of light in air or vacuum is 186,000 miles per second. In media that are more optically dense than air, the speed of light is slower. All colors of light travel at the same speed in air or empty space, but in denser media, the speed of light varies for different colors which accounts for the dispersion of light through a prism.

It is the difference in the speed of light through air, glass and other substances that accounts for the bending of light rays. Without this characteristic of light, a lens could not bend light rays to a focus.

REFLECTION

You know from experience that a mirror reflects light. A mirror will do predictable and dependable things to light. For example, you have looked at your own image in a flat mirror; from day to day you always look the same, or at least if you do look different, it's not the mirror's fault. The characteristic of the dependability of plane mirrors has given birth to the Laws of Reflection.

Terminology

Before actually stating the Law's of Reflection, let us make sure that we have our terminology straight. The ray of light that strikes the mirror is called the INCIDENT RAY; the ray that bounces off the mirror is known as the REFLECTED RAY. The imaginary line perpendicular to the mirror at the point where the rays striked is the NORMAL. The angle between the incident ray and the normal is the ANGLE OF INCIDENCE. The angle between the normal and the reflected ray is the angle of REFLECTION. These terms are shown for a plane mirror in Figure 3-5.

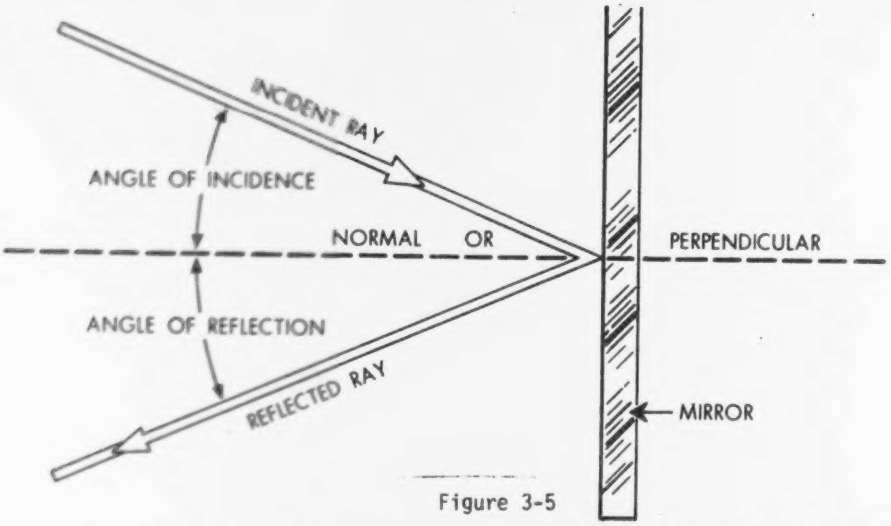

INCIDENT RAY
ANGLE OF INCIDENCE
NORMAL OR PERPENDICULAR
ANGLE OF REFLECTION
REFLECTED RAY
MIRROR

Figure 3-5

These terms look slightly different when applied to curved surfaces although definitions are the same. The major change is in how the normal is constructed perpendicular to a curved surface. It is a fact of geometry that the radius of a circle (line drawn from the center of the circle to its circumference) always meets the circumference at right angles. This means that to construct a normal to a curved surface, the center of the circle must be located on a line drawn from the center through the surface at the place where the incident light ray strikes. This is pictured in Figure 3-6.

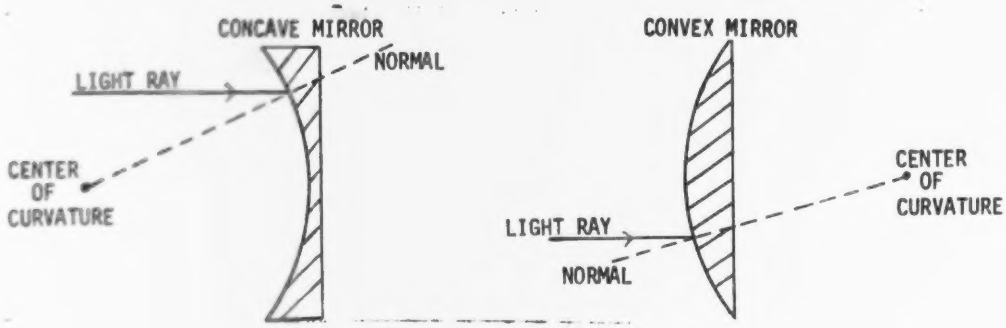

CONCAVE MIRROR
LIGHT RAY
NORMAL
CENTER OF CURVATURE
CONVEX MIRROR
CENTER OF CURVATURE
LIGHT RAY
NORMAL

Figure 3-6

Laws of Reflection

The laws of reflection are as follows:

1. THE ANGLE OF REFLECTION EQUALS THE ANGLE OF INCIDENCE.

2. THE INCIDENT AND REFLECTED RAY LIE ON OPPOSITE SIDES OF THE NORMAL.

3. THE INCIDENT RAY, THE NORMAL, AND THE REFLECTED RAY ALL LIE ALONG THE SAME PLANE.

By applying the laws of reflection, you can see that in all cases of reflection, the angle of reflection can be plotted if the angle of incidence is known or vice-versa.

Regular and Diffuse Reflection

Regular reflection occurs when light strikes a smooth surface and is reflected in a concentrated manner. You can plot the direction in which any single ray of light will be reflected, by erecting a perpendicular or normal at the point of impact and by applying the law of reflection.

Diffuse reflection occurs when a beam of light strikes a rough surface such as a sheet of unglazed paper, the light is not reflected regularly but is scattered in all directions. This is an example of diffuse reflected light.

Spherical Mirrors

A curved mirror either increases or decreases the vergence of a light ray. Such mirrors are classified as either a convex mirror - curved outwards - or a concave mirror - curved inwards. A convex mirror causes parallel light rays to diverge as in Figure 3-7.

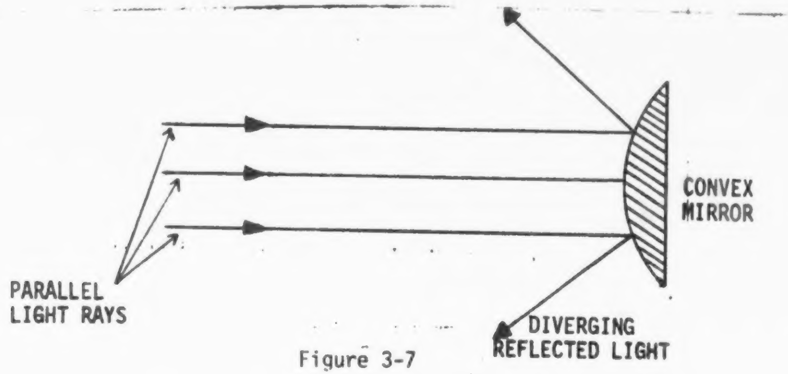


Figure 3-7

A concave mirror causes parallel rays of light to converge as in Figure 3-8.

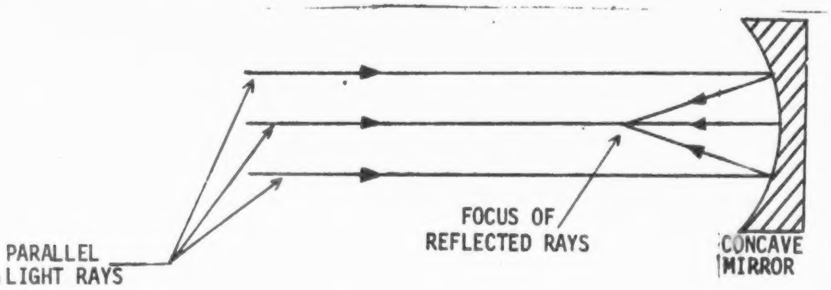


Figure 3-8

A light ray striking a mirror head on or perpendicular to the mirror is reflected back on itself.

When determining at what angle the light ray is reflected from a curved mirror, we construct a normal at the point of incidence. Then we apply the law of reflection, and the angle of reflection equals the angle of incidence.

Images

An image is the optical counterpart of an object produced by a lens, mirror or an optical system (including prisms). Two types of images are produced: (1) real and (2) virtual.

A REAL IMAGE ACTUALLY EXISTS AND CAN BE THROWN UPON A SCREEN. It is produced by real foci (points of intersection of light rays). An image formed on a photographic plate is a good example of a real image, as is an image formed on a motion picture screen.

A VIRTUAL IMAGE GETS ITS NAME FROM THE FACT THAT IT HAS NO REAL EXISTENCE. IT IS FORMED BY VIRTUAL (imaginary) FOCI AND CANNOT BE THROWN UPON A SCREEN. Your image in a mirror is a good example of a virtual image. Reflected rays of light from the mirror strike your eyes to form your image in it. Your image in the mirror, appears to be on the other side, but this is only an optical illusion produced by the plane mirror.

An optical element produces an image by collecting a beam of light from an object and transforming it into a beam which CONVERGES TOWARD or DIVERGES FROM ANOTHER POINT. If the beam actually CONVERGES to a point, it produces a real image of the object; if the beam DIVERGES from a point, it produces a virtual image of the object.

You can ascertain whether an image is real by holding a piece of paper where the image is formed. If you can see the image on the paper, IT IS A REAL IMAGE. If you can see the image but cannot form it on paper, IT IS A VIRTUAL IMAGE. If the image is backwards, the optical term is REVERTED, while ERECT is the optical term for right side up. INVERTED means upside-down. When you desire to describe an image - as compared to its actual object - you can say that it is:

1. Real or virtual
2. Erect or inverted
3. Normal or reverted
4. Of the same size as the object, larger (magnified) or smaller (minified) than the object.

Tracing Light Rays to a Concave Mirror

Now we are going to apply all the facts that you have learned by tracing light rays to a concave mirror. First off, we must construct normals at points where light rays are going to strike the concave mirror. If we continue the curve of the mirror until we have a full circle, then any radius drawn from the center of the circle to the circumference will be a normal, or perpendicular to the surface.

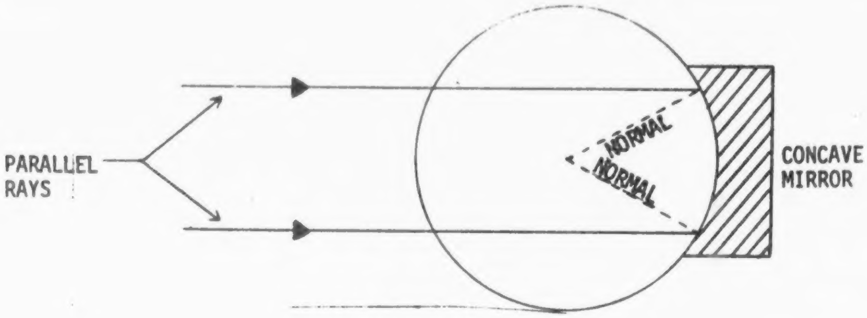


Figure 3-9

Once the normals have been constructed at the points where the incident rays contact the mirror, the angle of reflection can be determined as it equals the angle of incidence. The point where the reflected rays meet or cross is the FOCAL POINT of the mirror. (See Figure 3-10)

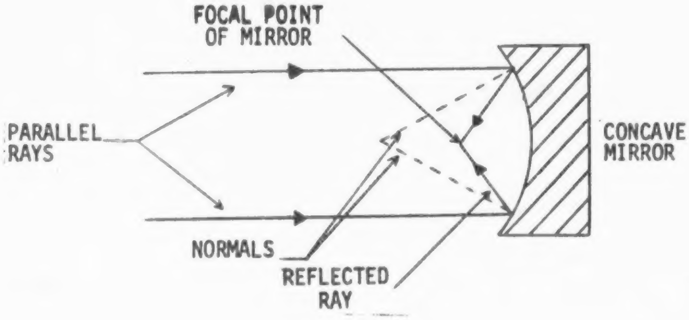


Figure 3-10

Tracing Light Rays to Convex Mirrors

The same principles used for a concave mirror can be used for a convex mirror. The normals are constructed in the same manner by drawing radii of curvature to the points where light strikes the mirror, then the angles of reflection will again equal the angles of incidence. The focal point is formed by the geometric extension of the reflected rays as in Figure 3-11

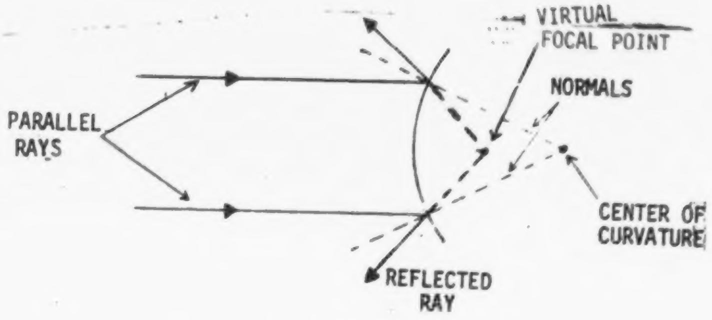


Figure 3-11

SUMMARY

The laws of reflection hold true for all mirrors - convex, concave, and plano. The amount of reflected light from curved surfaces depends upon the distance of the light source and the cirvatire of the reflecting surface. THE PRINCIPAL FOCUS OF A CONCAVE MIRROR IS REAL. THE PRINCIPAL FOCUS OF A CONVEX MIRROR IS VIRTUAL (imaginary). (For further study see page 22, Elements of Optics.)

REFRACTION

Much of your time in the Optometry clinic will be spent ordering, dispensing and dealing with lenses. It will make your work far more interesting if you know how and why these lenses work.

Basically all optical devices work on the same principle - the bending or refraction of light waves. Let us start off by familiarizing ourselves with some of the rules of optics.

Optical Sign Convention

You have already learned one of the rules of optical sign convention, convergent light is positive (+), divergent light is negative (-), and parallel light is zero(0) power. Another convention we adopt is the assumption that light always travels from left to right (if it doesn't, we flip the optical system around so that it does.) Any measurement made to the left of the lens is considered negative (-), and any measurement made to the right of the lens is considered positive (+). We use this method to classify lens types by where the focal point lies. Since a divergent lens causes light to have a virtual focus to the left of the lens, it is considered (-) and called a MINUS LENS. (See Figure 3-12)

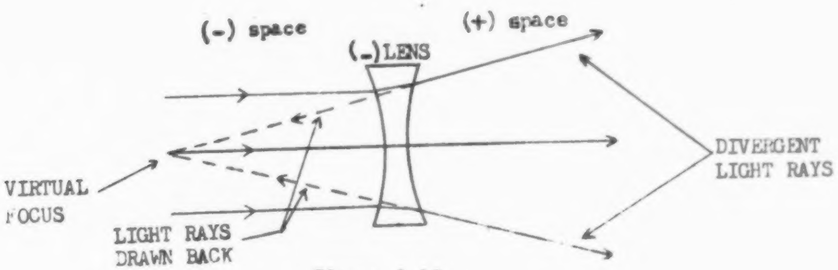


FIgure 3-12

You might notice on the above diagram that the reflected light rays are in plus space. However, the focal point of the lens is in negative (-) space, therefore the lens is a MINUS LENS.

On the other hand, a convergent lens causes light to have a real focus to the right of the lens, therefore it is in POSITIVE (+) space and called a PLUS LENS. (Figure 3-13).

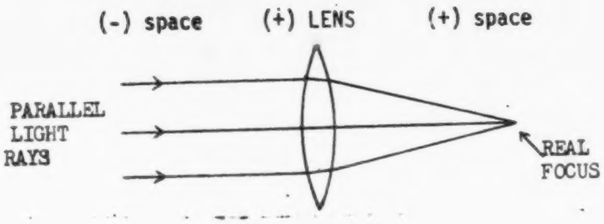


Figure 3-13

Convex lenses and convex mirrors do different things to light. Take a look at the mirror diagrams shown earlier, and make sure you can tell the difference between the effects of lenses and mirrors.

Definition of Refraction

We know now that all forms of light obey the same general laws. When light travels in a medium or substance of constant optical density, it travels in straight lines and at a constant speed. When light strikes a different medium from the one in which it is traveling, it is either reflected from or enters the medium. Upon entering a transparent medium, the speed of light is slowed down if the medium is more dense, or speeded up if the medium is LESS dense. If light strikes the medium at an angle its course is bent, or REFRACTED as it enters the medium. Refer to Figure 3-14.

Figure 3-14 shows what happens to light rays as they pass through a sheet of glass. Both plane surfaces of the glass plate are parallel and in contact with air. Glass and air are transparent but the glass is optically denser than air, so light will travel approximately one-third slower in glass than air.

When a light ray (wavefront) strikes the surface of the glass at right angles (parallel to the normal), it is not bent as it passes through the glass. See the left side of Figure 3-14 or Part A.

If a wavefront strikes the first surface of the glass at an angle, as illustrated in part B of Figure 3-14, one edge of the wavefront arrives at the surface an instant before the other edge; the edge of the wavefront, which arrives first, is slowed down before the second edge as it enters the denser medium. Observe that the second edge continues to travel at the same speed, until it strikes the surface of the glass. This slowing down of one edge of the wavefront before the other edge causes the front to PIVOT TOWARD THE NORMAL. A good comparison is a column of troops performing the movement - column half right. The inside files must slow down enough to allow time for the outer files to catch up. Think of the first edge of the wavefront to touch the glass as the inside file - it is slowed down by the greater density of the glass. The outer edge of the wavefront is still moving rapidly and so the inner edge catches up only by a change in angle of the complete wavefront. Pivoting or bending of light rays (wavefronts), as just explained, is called REFRACTION and the bent (pivoted) rays are called REFRACTED RAYS. The refracted rays continue to travel in the glass in a straight line, as shown in part B of Figure 3-14, until the surface from which they emerge (glass - to - air surface) causes interference. At this point, an opposite effect occurs to the wave. As one edge of the front reaches the surface, it speeds up and is bent away from the normal as it leaves the surface and resumes original speed (186,000 miles per second, at which it entered the glass). Again, THIS BINDING OR PIVOTING OF THE WAVEFRONT IS CALLED REFRACTION.

If the glass plate has parallel surfaces, the emergent light ray (ray refracted out of the glass) emerges from the second surface at an angle equal to the angle formed by the incident ray as it entered the glass. If you draw a dashed line along the emergent light ray (Figure 3-14), straight back to the apparent source of the ray, you will find that the emergent ray is parallel to the incident ray.

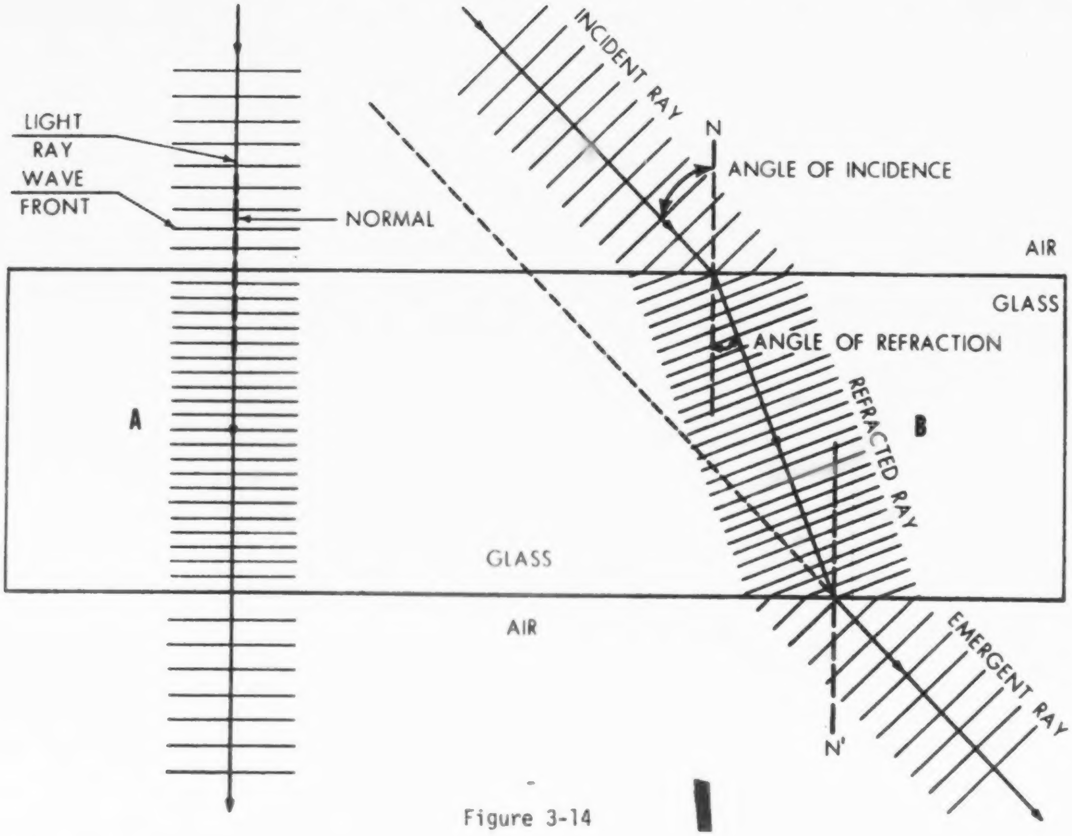


Figure 3-14

Laws of Refraction

The laws of refraction are very important for an overall understanding of lenses. The laws of refraction are condensed into the following four statements:

1. WHEN LIGHT TRAVELS FROM A MEDIUM OF LESSER DENSITY TO A MEDIUM OF GREATER DENSITY, THE PATH OF THE LIGHT IS BENT TOWARD THE NORMAL.

2. WHEN LIGHT TRAVELS FROM A MEDIUM OF GREATER DENSITY TO A MEDIUM OF LESSER DENSITY, THE PATH OF THE LIGHT IS BENT AWAY FROM THE NORMAL.

3. THE INCIDENT RAY, THE NORMAL, AND THE REFRACTED RAY ALL LIE IN THE SAME PLANE.

4. THE INCIDENT RAY LIES ON THE OPPOSITE SIDE OF THE NORMAL FROM THE REFRACTED RAY.

Study illustration 3-14 and carefully review the laws of refraction. Note the Normal, the ANGLE OF INCIDENCE and the ANGLE OF REFRACTION. This knowledge will be extremely valuable later in the course.

The amount of refraction is dependent upon the angle at which light strikes a medium and the density of the new medium - the greater the angle of incidence and the greater the density of the new medium, the greater the angle of refraction. If the faces of the medium are parallel, the bending of light at the two surfaces is always the same. As illustrated in part B of Figure 3-14, the beam that leaves the optically denser medium is parallel to the incident beam because it is returning to the same medium from which it started.

Factors Influencing Lens Power

There are many factors influencing lens power but the two primary variables are surface curvature and index of refraction.

INDEX OF REFRACTION. As you learned earlier the speed of light in a vacuum is 186,000 miles per second, while in other substances it travels slower because they are "optically denser." For example. light travels through ordinary glass at only 120,000 m.p.s. The ratio between the speed of light in a vacuum and the speed of light in a medium is known as the INDEX OF REFRACTION of that medium and is conventionally denoted by the letter n. The formula is:

$$\text{Index of Refraction } (n) = \frac{\text{velocity of light in vacuum}}{\text{velocity of light in medium}}$$

So in effect, index of refraction is just a way of relating the speed of light to optical density. The slower light travels, the more dense the medium and the higher its index of refraction.

EXAMPLE:

$$\text{Index of Refraction (glass)} = \frac{186{,}000 \text{ mps}}{120{,}000 \text{ mps}} = 1.55$$

The following is a list of indices of refraction for some substances:

Vacuum	1.00000
Air	1.000293
Water	1.333
Boro-silicate crown glass	1.517
Thermosetting cement	1.529
Canada Balsam	1.530
Gelatin	1.530
Light Flint glass	1.588
Medium Flint glass	1.617
Dense Flint glass	1.649
Densest Flint glass	1.963
Diamond	2.416

NOTE: You will be given the index of refraction if you need it for computations, so don't try to memorize them.

SURFACE CURVATURE. One way to measure surface curvature is by use of the radius from the center of curvature. A more curved surface will have a shorter radius of curvature than a less curved surface, as demonstrated in Figure 3-15.

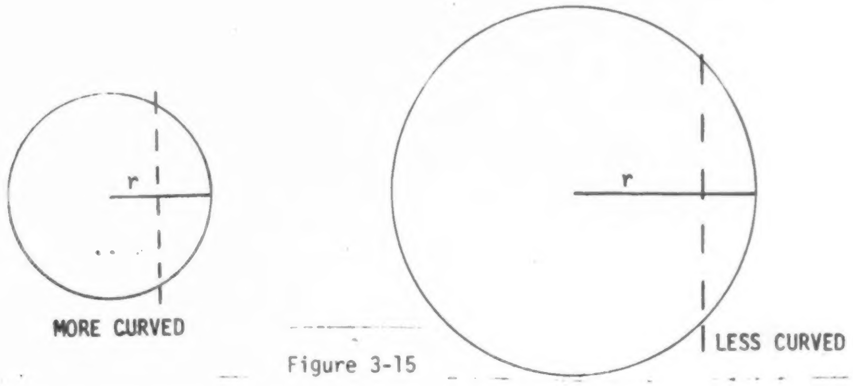


Figure 3-15

NOTE: Radius of curvature is indicated by the lower case letter r.

SNELL'S LAW. From his observation, Willebrord Snell, a mathematician and astronomer at the University of Heyden, determined the following relationship called Snell's Law.

$$\frac{\sin i}{\sin r} = \frac{n_2}{n_1}$$

Where i equals the angle of the incidence, r equals the angle of refraction, n is the index of refraction of the medium the light is in, and n_2 is the index of refraction of the medium the light is about to enter.

It is therefore possible to determine the angle of refraction by knowing the angle of incidence (directly related to surface curvature and radius of curvature) and the indices of refraction of the two mediums on either side of the interchange.

Snell's Law also effectively proves the LAW OF REVERSIBILITY, which states that if the path of a light ray is reversed, it will retrace its path exactly, no matter how many prisms, mirrors, or lenses there are in the orginal system.

Vergence of Light Rays

During the latter part of the 18th century, scientists recognized that radiations from hot bodies consisted of electromagnetic waves of the same fundamental nature as light waves. Luminous light sources such as the sun or the glowing filament of an electric light bulb act as oscillators in radiating energy in the form of light waves, and these waves spread out in all directions from their sources.

Because light travels outward in all directions from its source, the waves take the form of growing spheres, the luminous point of which is the center.

Single rays of light do not exist, but the term light ray is used throughout this SW for the sake of clarity and convenience in showing the direction of the wavefront. Light is indicated by one or more light rays with arrowheads to indicate the direction of travel.

Refer now to Figure 3-16 and observe that light is diverging in all directions form the light bulb. The figure shows lines with arrowheads to indicate that the direction of travel is along the radii of the sphere of light and at right angles to the fronts of the waves. The light which travels along each of these radii is designated as a light ray.

A wavefront which radiates from the light source is more curved when it is near the source. As these waves move outward, the wavefront becomes less curved and eventually almost straight. After traveling a distance of 2,000 yards from the light sources, wavefronts are considered to be parallel to each other. A parallel wavefront is neither converging nor diverging and is said to have zero (0) wave power.

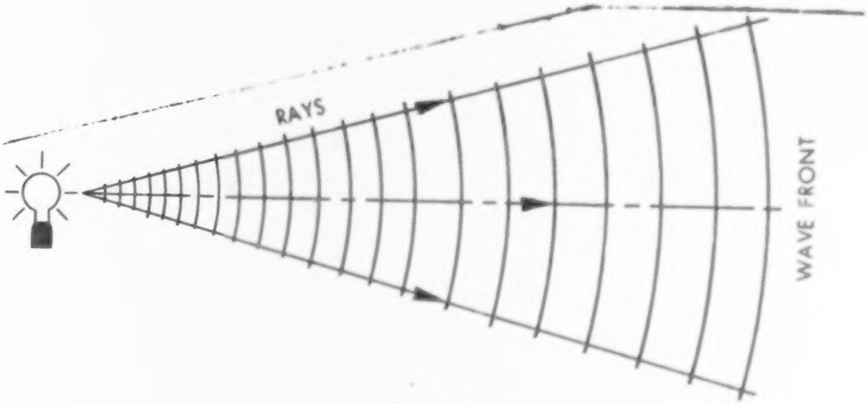


Figure 3-16

Divergent light is spreading out from a source or focus and is said to have negative (-) wave power. Divergent light is easily found in nature but it may also be produced by a minus lens. Minus lenses are concave and thinner in the middle than at the edges.

Convergence of light rays occurs only after the light has passed through some type of optical system. Convergent or plus (+) lenses produce convergent or plus light. Plus lenses are convex and thicker in the middle than at the edges.

The laws of refraction may be applied to plus and mius lenses as illustrated below in figures 3-17 and 3-18. Construct the normal by finding the center of the circle of which the lens is a part and draw the radii. Remember that light traveling into a denser medium is bent toward the normal, and light traveling into a less dense medium is bent away from the normal.

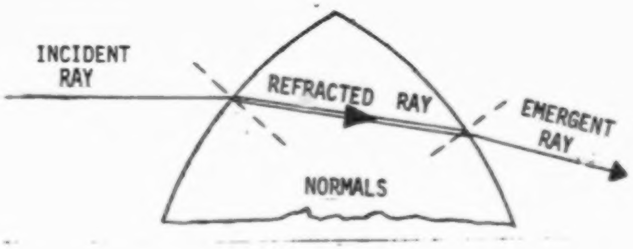

INCIDENT RAY
REFRACTED RAY
EMERGENT RAY
NORMALS

Figure 3-17

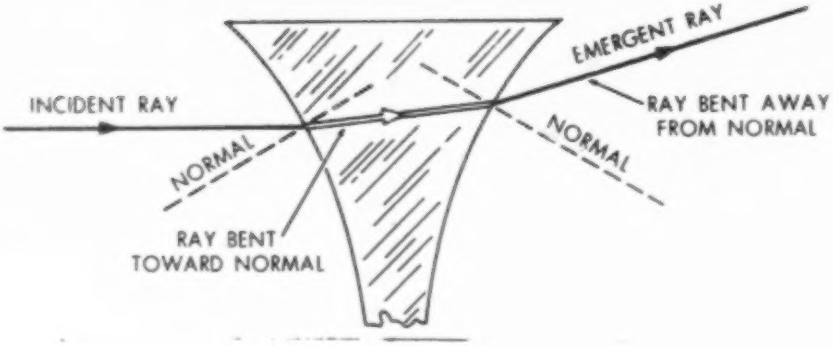

EMERGENT RAY
INCIDENT RAY
RAY BENT AWAY FROM NORMAL
NORMAL
NORMAL
RAY BENT TOWARD NORMAL

Figure 3-18

We have one more optical device , the prism, to introduce at this time. A prism has two surfaces that are not parallel. If we apply the laws of refraction to a prism (Figure 3-19- we find that light is deviated toward the base of the prism. The orientation of a prism is always given in terms of the base i.e. base up, down, in or out.

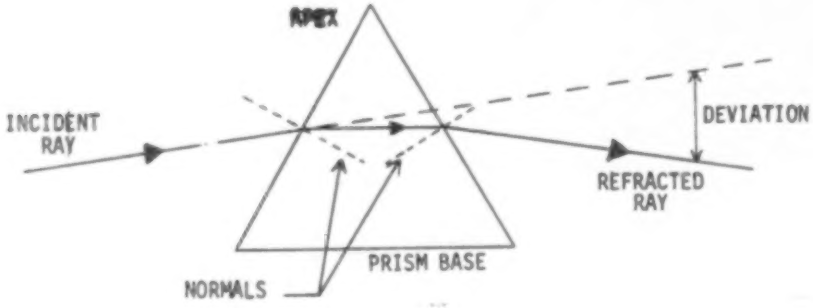

APEX
INCIDENT RAY
DEVIATION
REFRACTED RAY
PRISM BASE
NORMALS

Figure 3-19

When we speak of refraction through a prism we usually call it DEVIATION.

Because sunlight includes the whole range of wavelengths between 400 mu and 700 mu, it is a mixture of all visible colors between red (700 mu) and violet (400 mu). When sunlight passes through a prism, wavelengths of various colors refract at different angles toward the base of the prism and produce the spectrum of colors on a piece of paper. This breaking down of white light into its component colors is called DISPERSION (Figure 3-20)

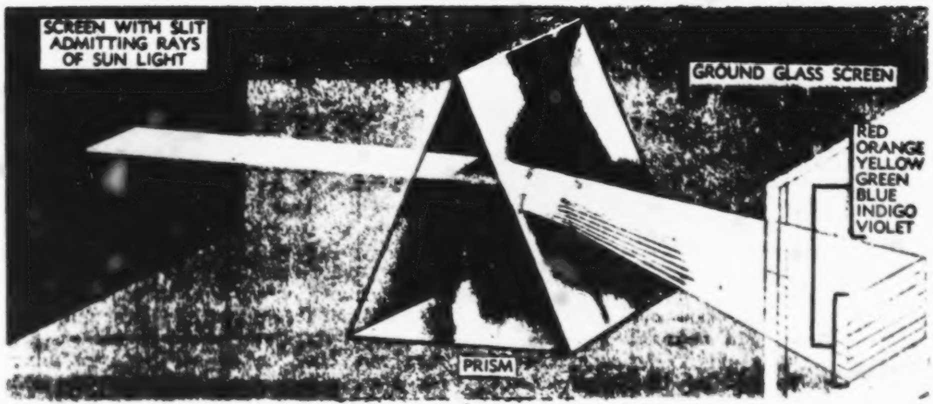
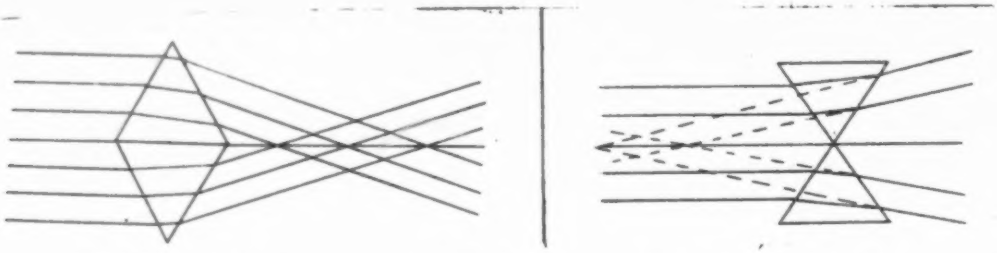


Figure 3-20

It is possible to picture a plus or minus lens as two prisms. Later on we will cover the prismatic qualities of ophthalmic lenses in greater detail, but for now just compare the elements pictured in Figure 3-21 with plus and minus lenses.



MULTIPLE REAL FOCI

Figure 3-21

MULTIPLE VIRTUAL FOCI

Next we will be exploring the mathematics of optical systems, but you must remember that: a divergent ray or wavefront is considered as having negative (-) power, a convergent ray or wavefront is considered as having positive (+) power, a parallel ray or wavefront has zero (0) power, prisms always deviate light toward the base, and any lens may be thought of as two prisms base to base (a plus lens) or apex to apex (a minus lens) with their edges rounded off.

FOR FURTHER STUDY YOU MAY READ:

1. Stein and Slatt, The Ophthalmic Assistant, pages 32-38 up to "Focal Length."
2. American Optical - Elements of Optics, pages 5-10.

POLARIZATION

Polarization is the act, process, or result of altering the presumed transverse wave motion of radiant energy, such that it is not uniform in amplitude in all directions in a plane perpendicular to the direction of propagation. The first man to define this act was Fresnel.

The following example illustrates the theory of polarization. Suppose that a rope is passed through the slats of a picket fence: if the rope is vibrated parallel with the slats, transverse waves would be able to pass through; but if the rope is vibrated at right angles to the slats, the waves would not be able to pass through, as illustrated in Figure 3-22. Poloroid lenses act as slats in the fence, except they act on light waves. By using two poloroid lenses, you can cancel out light completely. The first lens will allow some of the light to pass through to the second lens. If the second lens is turned 90^0 to the first, all remaining light will be eliminated.

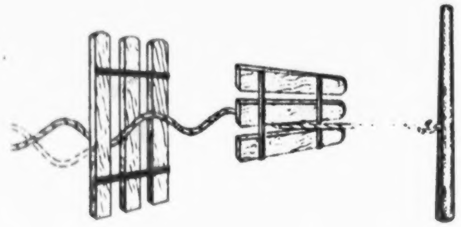


Figure 3-22

ABSORPTION

Absorbed light is that which is neither transmitted nor reflected in an optical system, but may be re-emitted as light of another wavelength. The amount of absorption that takes place in a lens depends on several factors including index of refraction and density of lens tint. To simplify this process think of an ophthalmic lens tinted to some shade of green. As white light strikes the surface that one wavelength, which corresponds to the shade of green tint in the lens, is transmitted. The other wavelengths are absorbed. Thus we have absorption. Every lens has a transmission curve which means that every wavelength is transmitted or absorbed to some extent depending on the tint or lack of tint.

EXERCISE 1-3a

INSTRUCTIONS

Complete the following statements associated with geometrical optics:

1. Light is that which we see by refers to the ________________ definition of light.

2. The three theories of light propogation are the ________________, ________________, ____________.

3. The ______________ theory is used to explain emission and absorption of light.

4. Rectilinear propogation of light studies showed that light ______________________________________.

5. The _____________ is the top of a wave and the trough is the bottom. These may also be called ____________________________ and __________________________________.

6. The distance between any point on a wave to the same point on an adjacent wave is called the __________________________________.

7. The greater the amplitude of a light wave the ________________________ the light will be.

8. __________________ is the number of waveforms that pass a given reference point in a measured amount of time.

9. A convex mirror will cause parallel light rays to become ______________________________.

10. The optical counterpart of an object produced by a lens, mirror, or other optical device is called the ________________________________.

11. Convergent light is considered ________________________ power, divergent light __________________ and parallel light _____________________ power.

12. Bending or pivoting of a wavefront through a lens is called ________________________________

13. The two primary variables influencing lens power are __________________ and _______________________.

14. After traveling a distance of _____________________ from their light sources, wavefronts are considered to be parallel to each other.

15. Light passing through a prism is deviated toward the _____________________________.

16. The act, process, or result of altering the presumed transverse wave motion of radiant energy, such that it is not uniform in amplitude in all directions in a plane perpendicular to the direction of propogation is called ____.

17. Light that is neither transmitted nor reflected in an optical system is ____________________________.

OPTOMETRIC MATH

OBJECTIVE 1-3b

Given WS J3ABR91235 000-1-3b, solve 50 Optometric Mathematical problems with 70% accuracy.

Algebraic Addition

Algebraic addition is very simply combining two or more numbers together. If you always think of algebraic addition in terms of dollars and cents you probably won't make any mistakes. It's really amazing that people who are terrible in math always seem to know their bank balance or how much change they should get back from a purchase. Throughout this section the examples will be explained mathematically and where possible, monetarily.

ALGEBRAIC ADDITION OF TWO PLUS NUMBERS. Algebraic addition of two plus (+) numbers will always give an answer that is plus. You quite simply add the numbers together and give the answer a plus (+) sign.

EXAMPLE 1: $\begin{array}{r} +2.50 \\ +1.75 \\ \hline +4.25 \end{array}$ or +2.50 + 1.75 = +4.25

Monetarily speaking, if you have (+) \$2.50 and you are given (+) \$1.75, how much do you have all told? \$4.25 to the good or plus.

EXAMPLE 2: $\begin{array}{r} +12.00 \\ +\ 5.75 \\ \hline +17.75 \end{array}$ or 12.00 + 5.75 = +17.75

In money terms, if you have (+) \$12.00 in your bank balance and you receive (+) a check for \$5.75 your new balance would be \$17.75 to the good or plus.

ALGEBRAIC ADDITION OF TWO MINUS (-) NUMBERS. Algebraic addition of two minus numbers will always give an answer that is minus. You ADD the two numbers together and give the answer a minus (-) sign.

EXAMPLE 1: $\begin{array}{r} -2.50 \\ -1.75 \\ \hline -4.25 \end{array}$ or -2.50 - 1.75 = -4.25

In terms of money, let us say that you owe (-) a friend \$2.50 and you borrow (-) another \$1.75, you then owe him (-) \$4.25.

EXAMPLE 2: $\begin{array}{r} -12.50 \\ -\ 9.50 \\ \hline -22.00 \end{array}$

Let us say that in the first hand of a poker game you lose (-) \$12.50 and the second hand you lose (-) \$9.50. You are then \$22.50 in the hole (-), and you'd better stop playing before you lose your shirt.

ALGEBRAIC ADDITION OF A PLUS AND A MINUS NUMBER. Combining a plus and a minus number together will give the same sign in the answer as the sign of the larger number. You take the difference between the two numbers by subtracting the smaller number from the larger.

EXAMPLE 1: +12.50 - 9.50 = +3.00 or $\begin{array}{r} +12.50 \\ -\ 9.50 \\ \hline +\ 3.00 \end{array}$

In money terms, if you have (+) \$12.50 in your bank balance and you write a check to pay a bill (-) for \$9.50 you'll still have (+) \$3.00 in your account.

EXAMPLE 2: +7.50 - 9.00 = -1.50 or $\begin{array}{r} -9.00 \\ +7.50 \\ \hline -1.50 \end{array}$

Let us suppose that in the first hand of our poker game you lose (-) \$9.00 and in the second hand you win (+) \$7.50, your standing after two hands is then \$1.50 in the hole or minus.

EXERCISE 1-3b-1

Albebraically add the following numbers.

1. +2.75 + 6.75 =
2. -13.00 + 15.25 =
3. -10.25 - 8.25 =
4. +1.75 - 1.25 =
5. +14.50 + 2.25 =
6. -2.75 - 22.25 =
7. -5.50 + 2.75 =
8. +1.25 - 1.25 =
9. -0.25 - 0.75 =
10. +4.12 + 5.37 =

Multiplication and Division of Like and Unlike Signs

When multiplying or dividing two numbers with like signs i.e., both plus (+) or both (-) the answer will always be a plus (+) sign. This means that if you multiply or divide two plus (+) numbers you will get a plus(+) answer and if you multiply or divide two minus numbers you will get a plus (+) answer.

EXAMPLES: $-2 \times -2 - +4$ $\frac{-18}{-9} = +2$

$+5 \times +8 = +40$ $+15 \div +3 = +5$

$(-2)\ (-2) = +4$

$(+5)\ (+8) = +40$

N.B. Two sets of brackets placed together, as in the last two examples above, means multiplication.

When multiplying or dividing unlike signs, i.e. one plus (+) and one minus (-), the answer will always be minus (-).

EXAMPLES: $-3 \times +6 = -18$ $\frac{-18}{+2} = -9$

$(+4)\ (-8) = -32$ $+25 \div -5 = -5$

These two rules may be compiled into a table that should be memorized.

+ x + = +
- x - = +
+ ÷ + = +
- ÷ - = +

- X + = -
- ÷ + = -

The importance of knowing the above rules cannot be overemphasized .

EXERCISE 1-3b-2

Simplify the following

1. $-4 \times -7 =$
2. $\frac{+36}{-2} =$
3. $(+40)\ (-2) =$
4. $+48 \div +8 =$
5. $\frac{-21}{-3} =$
6. $\frac{-15}{+3} =$
7. $\frac{(+8)\ (-2)}{-4} =$
8. $\frac{-36}{(-3)\ (-2)} =$
9. $\frac{+10}{(-5)\ (+2)} =$
10. $\frac{+6\ -\ 2}{-2} =$

Multiplication and Division of Decimals

A decimal number is just a whole number and a fraction written together in decimal form. Any multiplication or division by 10, 100, 1000, etc. simply moves the decimal place to the left or right. For example, multiplying a decimal by 10 would move the decimal point 1 place to the right, or dividing by 100 (10 x 10) would move the decimal point 2 places to the left.

MULTIPLICATION OF DECIMALS. Decimals are multiplied exactly like whole numbers and then the decimal point is added. For example, you would multiply 25 x 25 in this way:

$$\begin{array}{r} 25 \\ \underline{\times 25} \\ 125 \\ \underline{50} \\ 625 \end{array} \qquad \text{and } 2.5 \times 2.5 \text{ like this:} \qquad \begin{array}{r} 2.5 \\ \underline{2.5} \\ 125 \\ \underline{50} \\ 6.25 \end{array}$$

The number of decimal places in a decimal is the number of digits (numbers) to the RIGHT of the decimal point. The number of decimal places in the product (answer) of a multiplication is the SUM total of the decimal places in the numbers that were multiplied. For example, there are 2 decimal places in 140.21 and 3 in 14.021, therefore, there would be 5 decimal places in the product of those two numbers if they were multiplied.

Zeros written to the right of a decimal point with no number other than zero to their right may be dropped in most multiplications. Thus 4.20 may be written 4.2, but zeros to the right of the decimal point WITH NUMBERS OTHER THAN ZERO TO THEIR RIGHT CANNOT BE DROPPED, without changing the value of the number. Thus you cannot drop the zero in the number 6.105.

Zeros to the left of a decimal point with no number other than zero to their left are added only to make it very clear that the number is a decimal and may be dropped when you multiply. Thus 0.4 is exactly the same as .4 and 0.23 is the same as .23.

EXAMPLE 1: 4.32 x 2.10

$$\begin{array}{r} 4.32 \\ \underline{2.10} \\ 4320 \\ \underline{864} \\ 9.0720 \end{array}$$

Notice that the 4 decimal places in the answer are counted from right to left.

EXAMPLE 2: 1600.0 x 0.04

$$\begin{array}{r} 1600.0 \\ \underline{0.04} \\ 64.000 \end{array}$$

ANSWER: 64.0 or 64

DIVISION OF DECIMALS. Divisions may be written in the form $\frac{a}{b} = c$ or $a \div b = c$ or $b\overset{c}{\overline{)a}}$ where a is the DIVIDEND, b is the DIVISOR, and c is the QUOTIENT. As with multiplication, you divide decimals exactly like you do whole numbers and then you find the decimal place. For example: dividing 126 by 6 gives 21 as an answer.

$$\begin{array}{r} 21 \\ 6\overline{)126} \end{array}$$

and dividing 12.6 by 6 gives the answer 2.1

$$\begin{array}{r} 2.1 \\ 6\overline{)12.6} \end{array}$$

Notice that the decimal point in the quotient (answer) is directly above the decimal point in the dividend.

Anytime there is a space or a number of spaces between the decimal point and the first number of the quotient, you must add zeros to complete your answer. Thus in $\begin{array}{r} .31 \\ 8\overline{).248} \end{array}$ you must add a zero after the decimal point but before the three. As a result the problem and correct answer would look like this:

$$\begin{array}{r} .031 \\ 8\overline{).248} \end{array}$$

To carry out a division as far as necessary you must often add zeros to the dividend. As we have seen before, this does not change the value of the number. Thus, in $.9/2 = 2\overline{).9}$ it is necessary to add a zero to .9 to produce $\begin{array}{r} .45 \\ 2\overline{).90} \end{array}$

When the divisor is a decimal you may change it to a whole number by moving the decimal point to the RIGHT. When the decimal point is moved in the divisor, IT MUST BE MOVED THE SAME NUMBER OF PLACES IN THE DIVIDEND. If you move the decimal two places in the divisor, you must also move it two places in the dividend. For example.

$$\frac{0.88}{0.2} = .2\overline{).88}$$

We must move the decimal in both divisor and dividend, one place to the right. This then gives us $\begin{array}{r} 4.4 \\ 2.\overline{)8.8} \end{array}$ as a result. When the divisor is a whole number we just divide like whole numbers.

Exercise 1-3b-3

Mulitply or divide the following.

1. +0.19 x -0.20 =
2. -0.034 x -0.025 =
3. +12.48 ÷ +8.0 =
4. -0.008 ÷ -800.0 =

5. +4.12 x -5.75 =

6. -0.0012 ÷ +.002 =

7. +0.890 x -6.00 =

8. $\frac{-0.800}{+8.000} =$

Metric System

The metric system is based on decimals. Changing from one unit to another requires only the movement of the decimal place. The table below shows the meter, which is the standard unit of length, and the parts of a meter that we will be concerned with in Optometry. It also shows the standard abreviations and the number of units in a meter.

1 meter (m) = 1 meter

100 centimeters (cm) = 1 meter

1000 millimeters (mm) = 1 meter

You can see that the metric system is quite similar to our monetary system of dollars and cents. When you are making your conversions from one unit to another think in terms of dollars and cents and you probably won't make a mistake. The chart below will assist you in seeing the relationship.

1 m = 1 dollar

1 cm = 1 cent

1 mm = 1 mil

There are 10 mils in 1 cent.

If you consider cm as cents, mm as mils and meters as dollars you will find your conversions much easier. Most of us understand that the notation $0.40 means 40 cents so in a similar fasion 0.40 m equals 40 cm. This process is actually accomplished by moving the decimal place in 0.40 m two places to the right to give us 40.0 cm. Thus we will find that to convert from one metric unit to another simply means the movement of the decimal point. This requires deciding (1) how many places to move the decimal point and (2) whether to move it right or left.

Dealing with the problem of how many places to move the decimal is relatively easy. Note in the table above that there is a difference of 2 zeros between centimeters and meters, 3 zeros between millimeters and meters, and 1 zero between millimeters and centimeters. This means that when converting between:

1. meters and centimeters move the decimal 2 places.

2. meters and millimeters move the decimal 3 places.

3. centimeters and millimeters move the decimal 1 place.

Deciding on which direction (right or left) to move the decimal requires thinking about whether you should have more or less of the unit that you desire. For example, if you are given a length in meters and require the length in centimeters, then you must have more centimeters than you had meters because each centimeter is smaller than each meter. This means that you would move the decimal 2 places TO THE RIGHT. Conversely if you were converting from centimeters to meters, you have to move the decimal place to the left 2 places. A meter is a much larger unit of length than a centimeter, thus you would have to have less meters than you had centimeters. All of the possible metric conversions you will have to make are listed on the next page. Memorize them; if necessary.

When Converting	Move Decimal
m to cm	2 places right
cm to mm	1 place right
m to mm	3 places right
mm to m	3 places left
mm to cm	1 place left
cm to m	2 places left

Some examples are provided below:

EXAMPLES

1. How many cm are there in 0.20m? Solution: move the decimal 2 places to the right giving you:
   0.20m = 0 2 0. = 20.0 cm
2. Convert 358 cm to mm. Solution: move the decimal 1 place to the right. 358.0 cm = 358.0. = 3580 mm
3. Convert 0.0008 mm to m. Solution: move the decimal 3 places to the left.
   0.0008 mm = .0000008 = .0000008 m
4. How many cm are there in 250 mm? Solution: move the decimal 1 place to the left.
   250.mm = 25.0 = 25.0 cm
5. You measure a distance to be 0.12 mm. How many cm are there in 0.12 mm? Solution: move the decimal 1 place to the left.
   0.12 mm = .012 = 0.012 cm

The only other conversion you are likely to make is between inches and some unit of the metric system. For example, you may be given a length in inches and require it in meters. There are approximately 40 inches in 1 meter so if you divide by 40 you will have the length in meters.

EXAMPLES:

80 in. = $\frac{80}{40}$ = 2 m

5 in. = $\frac{5}{40}$ = 0.125 m

Should you desire a length, given in meters, converted to inches then multiply by 40.

EXAMPLES:

0.5 m = 0.5 x 40 = 20 in.

4.0 m = 4.0 x 40 = 160 in.

1.25 m = 1.25 x 40 = 50 in.

If you need a length, in inches, converted to centimeters or millimeters, first convert the inches to meters (divide by 40) then convert to the desired unit by moving the decimal place. Conversely, if you wish to convert from cm or mm to inches, then first convert to meters by moving the decimal and multiply by 40 to convert the meters to inches.

EXAMPLES:

1. How many mm are there in 16 inches? Solution: convert 16 in to meters by dividing by 40. Then move the decimal 3 places to the right.

   16 in = $\frac{16}{40}$ = 0.4m = 0400.mm = 400 mm

2. How many inches are there in 20 cm? Solution: convert 20 cm to meters by moving the decimal 2 places to the left and then multiply the meters by 40 to obtain inches.
   20cm = 0.20m
   0.20 X 40 = 8 inches

3. How many cm are there in a distance of 60 inches? Solution: divide 60 inches by 40 to obtain meters then move the decimal 2 places to the right to obtain cm.

$$60 \text{ in} = \frac{60}{40} = 1.5 \text{ m}$$

$$1.5\text{m} = 150. = 150 \text{ cm}$$

Review in your mind or reread the different conversions before attempting the exercises. Review sufficiently so that you can perform the conversions without referring back to the text. Should you desire more practice after completing the exercises, you can just pick a number, give it a unit and convert to any other unit. These conversions must become second-nature to you! (Study: "Fundamentals for the Optometric Assistant," Chapter 6, Section 4, page 132.)

EXERCISE 1-3b-4

Convert the unit of length on the left to the units requested on the right.

1. 42 m ________ cm
2. 500 mm ________ m
3. 80 in ________ cm
4. 0.025 cm ________ mm
5. 200 mm ________ in
6. 16 in ________ m
7. 25 cm ________ m
8. 0.47 m ________ mm
9. 10 cm ________ in
10. 150 mm ________ cm

Converting Fractions to Decimals

Fractions can be both common fractions and DECIMAL fractions. For example: 2/5 is a common fraction, and $\frac{1.1}{2.2}$ is a decimal fraction. The number above the dividing line in a fraction is the NUMERATOR. The number BELOW the dividing line in a fraction is the DENOMINATOR. A common fraction or decimal fraction may be converted to a decimal by dividing the numerator by the denominator. For example: $\frac{1}{2} = 2/\overline{1} = 0.5$

or $\frac{5.0}{0.2} = \begin{array}{r} 25.0 \\ 0.2/\overline{5.00} \end{array}$

EXERCISE 1-3b-5

Convert the following to decimals.

1. 1/4 =
2. 7/8 =
3. 3/4 =
4. 8/5 =
5. $\frac{-8.96}{+1.40}$ =
6. $\frac{-1.90}{+0.04}$ =

Solving for an Unknown in an Equation

A simple algebraic equation has an unknown quantity symbolized by a letter. For example, 2N = 8 is a simple algebraic equation. In an equation such as this, the unknown must be isolated on one side of the equation. You may do anything to isolate the unknown, just make sure that you do the same thing to BOTH sides of the equation. In 2N = 8, you can divide both sides of the equation by two in order to isolate N. This gives

$\frac{2N}{2} = \frac{8}{2}$ then $\frac{\cancel{2}N}{\cancel{2}} = \frac{\cancel{8}^{4}}{\cancel{2}}$ leaving us N=4

Remember this rule: Whenever you do something to one side of an equation, you must do the same thing to the other side.

2N = 12 then $\frac{\cancel{2}N}{\cancel{2}} = \frac{\cancel{12}^{6}}{\cancel{2}}$ leaving us N = 6

To isolate an unknown you may add, subtract, multiply or divide by any number as long as you do the same to both sides. You should add or subtract first and then multiply or divide to isolate an unknown.

EXERCISE 1-3b-6

1. 3x = 12 x =
2. 4x = 20 x =
3. 4x = 26 x =
4. 9y = 27 y =
5. 6y = 12 y =
6. 12x = 144 x =

Solving for an Unknown in A Proportion

Problems involving proportions are solved the same way as solving for an unknown in a simple algebraic equation. Here is an example of a proportion:

$$\frac{2}{3} = \frac{4}{x}$$

By writing a proportion in this way, we are saying that 2 is to 3 as 4 is to x. To solve this proportion simply CROSS MULTIPLY, or multiply the figures that are diagonally opposite. In the case $\frac{2}{3} = \frac{4}{x}$, 2 is diagonally opposite x and 3 is diagonally opposite 4.

Cross multiplying, we get 2 X x = 4 X 3 or 2x = 12. Then we just solve for x.

$\frac{\cancel{2}x}{\cancel{2}} = \frac{\cancel{12}^{6}}{\cancel{2}}$ leaving x = 6.

That's all there is to it. You will only have one unknown in a proportion, and by CROSS MULTIPLYING you can turn any proportion into a simple algebraic equation that you already know how to solve. Here are some more examples:

EXAMPLE 1: $\frac{14}{24} = \frac{x}{48}$
24 X x = 48 X 14
24x = 672
x = 28

EXAMPLE 2: $\frac{x}{14} = \frac{3}{7}$
x X 7 = 3 X 14
7x = 42
x = 6

EXERCISE 1-3b-7

Solve for the unknown in the following proportions. Carry your answers out to 2 decimal places.

1. $\frac{5}{x} = \frac{7}{35}$ x =
2. $\frac{3}{8} = \frac{15}{x}$ x =
3. $\frac{7}{30} = \frac{x}{21}$ x =
4. $\frac{5}{100} = \frac{20}{x}$ x =
5. $\frac{8}{400} = \frac{20}{x}$ x =
6. $\frac{15}{300} = \frac{20}{x}$ x =

Units of Angular Measurement

Refraction is based on the bending of light rays. This bending of light leads to the measurement of angles. An angle is formed by 2 lines joined at one end (the vertex) as shown in Figure 3-23.

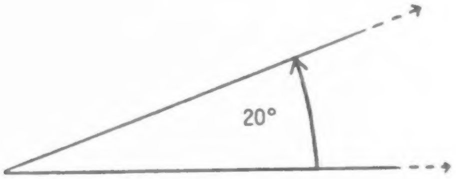


Figure 3-23

The angle shown here is 20° and it is important to note that the angle size does not change as the arms of the angle extend out. However, if you look at the distance between the arms, you should note that the farther from the vertex you measure - the greater will be the distance between the arms. For example: Suppose a rocket is launched to the moon 5° off course. This means that the angle between proper path of the rocket and the actual course is 5° with the vertex of the angle at the launching pad. The distance between the arms of the angle increases as the rocket gets further from the launching pad but the angle is still 5°. For example 20,000 miles from the launching pad the rocket will be off course about 1750 miles but at the moon (approximately 238,857 miles) the rocket will be off course about 20,900 miles. This is illustrated in Figure 3-24.

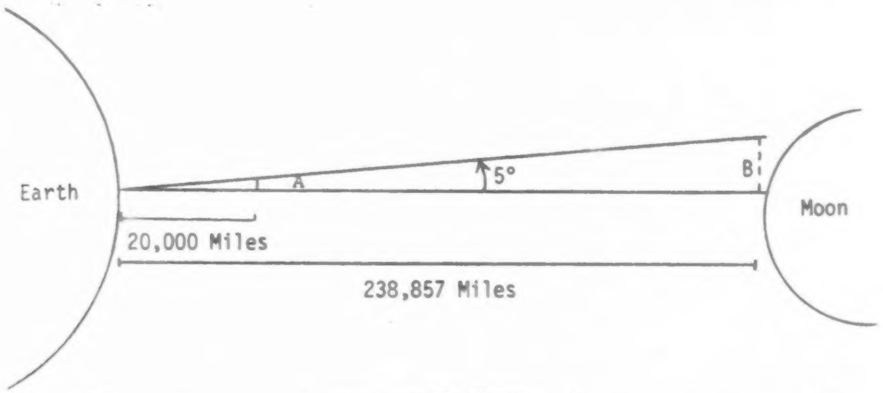


Figure 3-24

Where A = 1750 miles and B = 20,900 miles.

The measurement of angles is made in degrees (°), minutes ('), and seconds ("). The table below shows you the system of angular measurement we will be using in the course.

1. A circle = 360 degrees (°)
2. 1 degree = 60 minutes (')
3. 1 minute = 60 seconds (")

DIOPTERS

A DIOPTER is a unit of measurement of lens or wave power; it can also be thought of as the unit of measure of the refractive power of a lens or lens system.

A DIOPTER IS EQUAL TO THE RECIPROCAL OF THE FOCAL LENGTH IN METERS. The focal length of a lens is the distance between the lens and the focal point or focus. The focal length of a plus lens is real and formed by an actual intersection of light rays as in Figure 3-25.

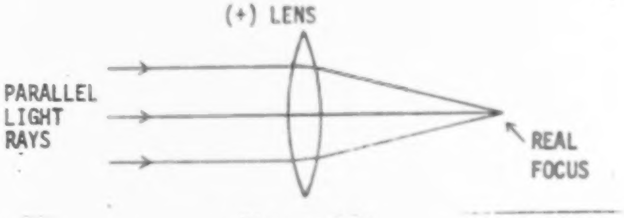


Figure 3-25

On the other hand, a minus lens diverges light and in reality these light rays will never cross or focus. But we may still find the focus by drawing back geometric extensions of the rays to form a virtual (imaginary) focus as in Figure 3-26.

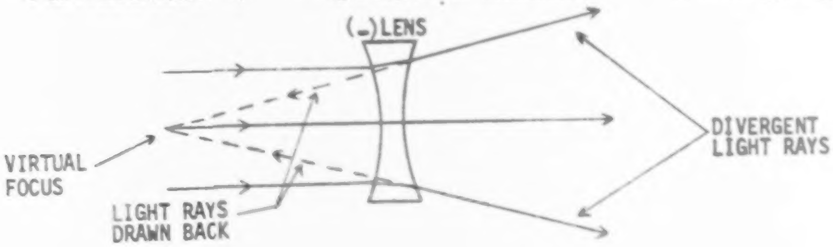


Figure 3-26

Since diopters of lens power are equal to the reciprocal of the focal length in meters, it may be expressed as:

$$D = \frac{1}{f(m)}$$

If D equals lens diopters, and f is the focal length in meters, a system with a focal length of 1 meter will have a power of 1 Diopter.

$$D = \frac{1}{1m} = 1.00D$$

A system with a focal length of 2 meters will have a power of:

$$D = \frac{1}{2m} = 0.50D$$

and a system with a focal length of 0.50 meters will have a power of:

$$D = \frac{1}{0.50m} = 2.00D$$

Our only problem then is to make sure that the focal length is in meters. Since not all focal lengths are measured in meters, we may modify the basic formula with a conversion factor for different units.

$$D = \frac{1}{f(m)} \qquad D = \frac{1000}{f(mm)}$$

$$D = \frac{100}{f(cm)} \qquad D = \frac{40}{f(in)}$$

So if you have a focal length in cm just plug it in to D = 100/f(cm) and the 100 will convert the cm to meters.

EXAMPLES: 1. A focal length of 10cm

$$D = \frac{100}{f(cm)} = \frac{100}{10cm} = 10.00D$$

2. A focal length of 250mm

$$D = \frac{1000}{f(mm)} = \frac{1000}{250} = 4.00D$$

3. A focal length of 16 inches

$$D = \frac{40}{f(in)} = \frac{40}{16} = 2.50D$$

The same dioptric power formula may also be used to determine focal lengths if you know the lens diopters. We may rearrange the formula to isolate f in the following manner:

$$f(m) = \frac{1}{D}$$

If you have a lens of 5.00D, it has a focal length of:

$$f(m) = \frac{1}{5} = 0.20m$$

If we wish to have our focal lengths in cm, mm, or inches we may use the same basic formula with an automatic conversion factor in the same way we did for diopters.

$$f(cm) = \frac{100}{D} \qquad f(mm) = \frac{1000}{D} \qquad f(in) = \frac{40}{D}$$

Examples: 1. A 3.00D lens will have a focal length, in cm, of

$$f(\text{cm}) = \frac{100}{D} = \frac{100}{3.0} = 33.33\text{cm}$$

2. A 10.00D lens will have a focal length, in inches, of

$$f(\text{in}) = \frac{40}{D} = \frac{40}{10.00} = 4.00 \text{ inches}$$

3. A 2.50D lens will have a focal length, in mm, of

$$f(\text{mm}) = \frac{1000}{D} = \frac{1000}{2.50} = 400\text{mm}$$

It's important to remember that a lens with a longer focal length is weaker than one with a shorter focal length. Conversely, a stronger lens has a shorter focal length than a weaker one.

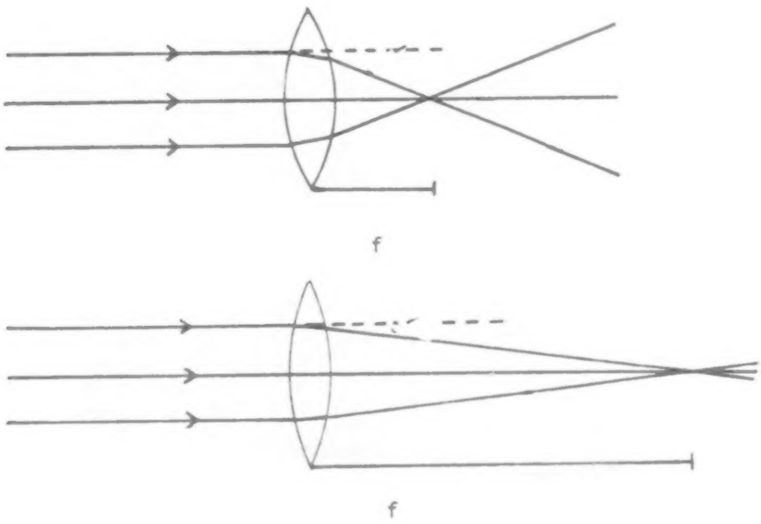


Figure 3-27

The power of an ophthalmic lens is always given in diopters, but in many instances it is useful to know the focal lengths of these lenses. Make sure you can convert freely between focal lengths and diopters before continuing.

Convert the following focal lengths to diopters, taking your answer to two decimal places.

1. 200 mm =
2. 25 cm =
3. 80 in =
4. 0.20 m =
5. 16 in =
6. 50 mm =
7. 33 cm =
8. 0.75 m =
9. 100 cm =
10. 5 m =

Convert the following diopters to focal lengths taking your answer to two decimal places.

11. 2.25 D = ______________ cm
12. 0.50 D = ______________ in
13. 2.50 D = ______________ mm
14. 3.33 D = ______________ m
15. 10.00 D = ______________ cm
16. 5.00 D = ______________ in
17. 0.25 D = ______________ mm
18. 1.00 D = ______________ m
19. 50.00 D = ______________ cm
20. 20.00 D = ______________ in

21. A person reads a newspaper at 16 inches. What dioptric power is striking the person's eyes?

22. A jeweler examines a diamond at a distance of 10 cm. What is the dioptric power of the light from the diamond when it strikes the jeweler's eye?

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OPHTHALMIC OPTICS

OBJECTIVES

This SW is designed to provide information on the following subjects:

Refractive qualities of ophthalmic lenses

Transposition of cylinder forms

Converting multi-focal Rx's to near or intermediate Rx's

Measuring base curves

Lens neutralization

INFORMATION

REFRACTIVE QUALITIES OF OPHTHALMIC LENSES

OBJECTIVE

Given WS J3ABR91235 000-1-4q, identify characteristics of ophthalmic lenses with 70% accuracy.

HISTORY OF OPHTHALMIC LENSES

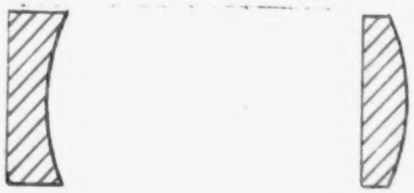
How long have people worn glasses? The first authentic record is a note written by Marco Polo when he visited the court of Kublai Khan in China in 1270. He noted that convex lenses were used by the aged to read fine print. In Europe, the famous English Franciscan monk Roger Bacon was the first to recognize the value of convex lenses for those who were old or had weak sight.

By the 17th century, spectacles were in common use, most fashioned with silver or gold frames. The really elite wore frames made of tortoise shell. In 1784 Benjamin Franklin glued 2 lenses together creating the 1st bifocal. Still, most spectacle lens quality was poor and many defects were inherent. It was not until the 20th century that spectacles began to be manufactured with quality glass.

Forms of Lenses

The physical form of a lens is determined by center thickness and surface curvature. The same power lenses may be made in different forms to minimize certain aberrations.

The first lens form to discuss is the flat or plano surface with zero (0) power. The other combined with either a convex(bulging out) or concave (caved in)surface. Such lenses are called PLANO-CONVEX or PLANO-CONCAVE illustrated in figure 4-1.

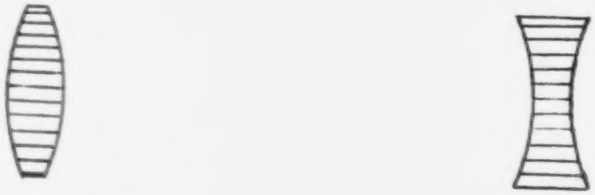


PLANO-CONCAVE

PLANO-CONVEX

Figure 4-1

When both surfaces are of the same power, these lenses are called BICONVEX (plus (+) power) or BICONCAVE (minus(-) power). The advantage of these lenses is that they can incorporate high power in a single lens. The disadvatage is that they amplify certain aberrations. The lenses are shown in Figure 4-2.

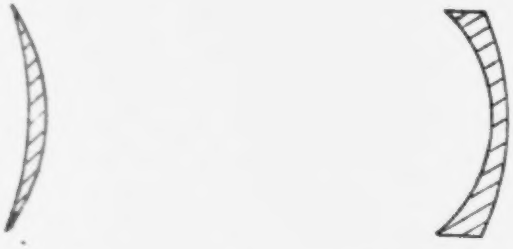


BICONVEX

BICONCAVE

Figure 4-2

The most common ophthalmic lenses are of the MENISCUS variety. Meniscus lenses have surfaces of, opposite power. When speaking of meniscus lenses, the FIRST TERM IN THE NAME IDENTIFIES WHETHER THE LENS IS PLUS OR MINUS. These lenses are illustrated below in Figure4-3.



POSITIVE MENISCUS

NEGATIVE MENISCUS

Figure 4-3

TYPES OF LENSES AND REFRACTIVE QUALITIES

Up to this point, we have discussed lenses only in respect to their effects upon light. Ophthalmic lenses, however, will be discussed in reference to their effects upon the eyes. We will start off by discussing terminology just to insure that we are all on the same wavelength.

Terminology

OPTICAL CENTER. That point on a lens where light passes without being refracted. This point on a lens is not necessarily the geometric (physical) center, although it may be. It is the thickest point on a plus lens or the thinnest point on a minus lens.

MERIDIAN. An imaginary line drawn across the optical center of a lens. When we speak of how much power a lens has in any given area, we are speaking about a meridian.

DIOPTER. The power of an ophthalmic lens is always measured in diopters.

SURFACE CURVATURE. One major factor influencing the power of a lens.

Ophthalmic Lenses

We have two major categories of ophthalmic lenses - single vision and multifocals. These, however, may be subdivided into spheres, cylinders, and spherocylinders. Let us take each one individually and look at their characteristics a little more closely.

SPHERES. A spherical lens is a lens where both surfaces are segments of spheres. They are characterized by equal radii of curvature and equal power in all meridians.
This does not necessarily mean that the front and back surfaces have the same curvature, but that the curvature on each surface will be the same anywhere on that surface.

Most ophthalmic lenses are of the meniscus variety, meaning that the front surface is plus and the back surface is minus. A plus sphere will have more power on the front surface than it will on the back and has a real point focus.

A negative sphere will have more power on the back surface than it will on the front and forms a virtual point focus.

Plano (0.00D) spheres neither converge nor diverge light. They are also of the meniscus variety with the back surface and the front surface having the same curvature but of opposite signs.

A spherical lens is usually denoted by the sign of the lens (+ or -), the dioptric power of the lens, and the abbreviation "sph". The right eye is abbreviated O.D. (oculus dexter, Latin), the left eye is abbreviated O.S. (oculus sinister, Latin), and both eyes is abbreviated O.U (oculus uterque). Thus

O.D. +3.25 sph

O.S. +1.75 sph

indicates that the right eye requires a plus (or convergent) 3.25 diopter spherical lens and the left eye requires a plus 1.75 diopter spherical lens.

Minus or divergent spherical lenses are denoted in the same fashion, such as

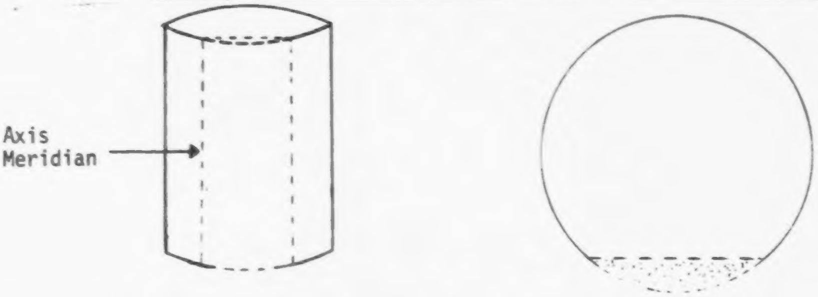
O.U. -0.50 sph

meaning both eyes require minus 0.50 diopter spherical lenses.

Plano or zero power lenses are denoted by "Plano" or simply "Pl."

EXAMPLE: O.D. Pl. sph.

CYLINDERS. A cylindrical lens gets its name from its resemblance to the side cut off a cylinder. Cylinders are characterized by having maximum power in one meridian and zero (0) power in the meridian 90° away. The zero (0) power meridian is called the AXIS meridian.



Dotted lines represent a section cut out of a cylinder forming a simple cylindrical lens.

Looking down through a cylinder. Dotted lines mark the lens section.

Figure 4-4

The power of this lens to bend light rays, when its axis is in the vertical position, is in the horizontal meridian only; no refraction is produced in the vertical plane. The reason that refraction occurs 90° away from the axis is because the lens has curvature in that meridian, whereas the axis meridian is flat, having zero (0) power. Cylinders are a major part of the study of ophthalmic optics so it would be well worthwhile to know this section well. Figure 4-5 is a simple cylinder. Study this diagram well and note the curvatures in the horizontal and vertical meridians and their respective effects on light rays.

It should be noted that the cylinder axis may be located anywhere between 001° and 180°. The Cylinder axis is not restricted to 90° and 180° positions.

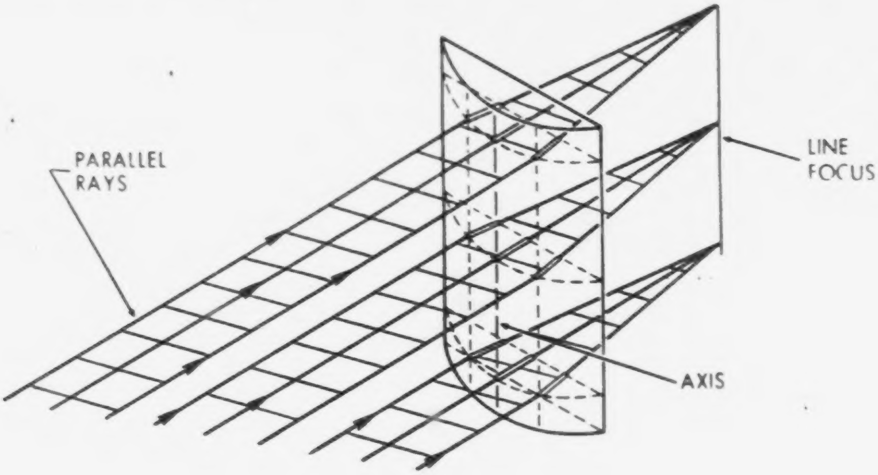


Figure 4-5

In the figure above, we can tell that there is zero power along the axis as the three sets of rays are not bent in the axis meridian, only in the horizontal meridian are the rays bent to a focus. The lens pictured in Figure 4-5 is a CONVERGENT cylindrical lens because the lens converges the light to form a REAL LINE FOCUS.

CONVERGENT CYLINDERS. Convergent cylinders are used rather extensively in spectacles and also for magnifying verniers (slide rule type) scales on instruments.

Rays striking perpendicular (90^0 away from) to the cylinder axis are refracted as they pass through the lens and converge at a point beyond the lens, forming a REAL LINE FOCUS PARALLEL TO THE CYLINDER AXIS.

DIVERGENT CYLINDERS. A divergent cylindrical lens acts somewhat like a divergent spherical lens, EXCEPT that a VIRTUAL LINE IMAGE IS FORMED PARALLEL TO THE CYLINDER AXIS.

Notation of a cylindrical prescription contains two parts: (1) the dioptric power of the maximum power meridian, including sign and (2) the orientation of the cylinder axis. The axis of a cylinder may be anywhere between 001^0 and 180° as shown below in Figure 4-6.

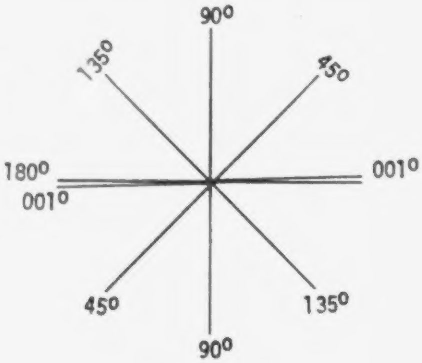


Figure 4-6

The axes below the 180^0 line are the same meridian as the corresponding axes above the 180^0 meridian.

An example of cylindrical power notation would be: +2.00 X 155 meaning a plus 2.00 diopter cylinder with the axis aligned at 155°. The degree symbol is omitted and axis is abbreviated simply "X".

SPHEROCYLINDERS. A spherocylindrical lens is a combination of a sphere and cylinder which acts upon light in a manner similar to both lenses. A spherocylindrical lens may also be called a TORIC or COMPOUND lens.

In this lens, there is an axis of most power and an axis of least power located 90° away from each other. The light rays striking each axis are considered separately. Since the axes are of differing powers, the light will focus at different distances from the lens.

A spherocylindrical lens forms a figure known as Sturm's Conoid, or Interval of Sturm, which is characterized by two line foci at right angles to each other, and a circle of least confusion located at the dioptric midpoint between the line foci.

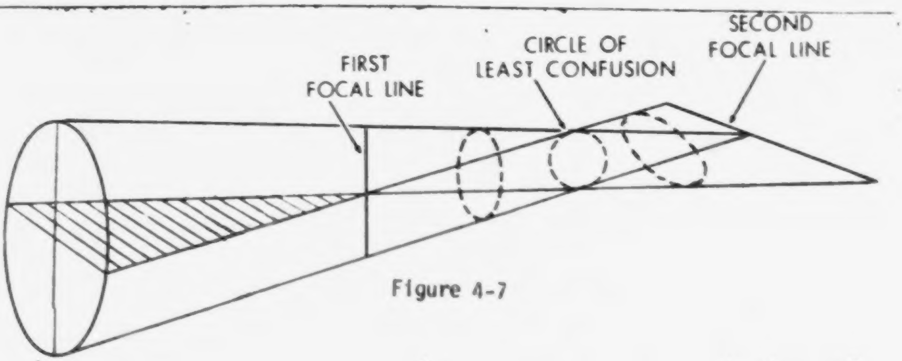


Figure 4-7

Since a spherocylindrical lens is a combination of a sphere and a cylinder, its prescription is denoted the same way. The first element is always the sphere power, the second element is always the cylinder power, and the third element is the orientation of the cylinder axis.

For example:

O.D. -1.25 - 0.50 ax 060

This prescription (Rx) means that the patient's right eye requires a -1.25 diopter sphere combined with a -0.50 diopter cylinder with its axis aligned at 060°.

A simple cylinder (containing 0 sphere power) is written with "Plano" or simply "Pl" as the sphere power and this indicates that the lens contains only cylinder power.

For example:

O.S. Pl +1.25 X 125

This Rx says that the patient requires zero sphere power but needs +1.25 D of cylinder with the axis at 125°. This lens provides zero power along the 125° meridian, with the cylinder exerting its maximum power of +1.25 D (90° away from the cylinder axis) in the 35° meridian, as pictured in figure 4-8.

pl +1.25 X 125

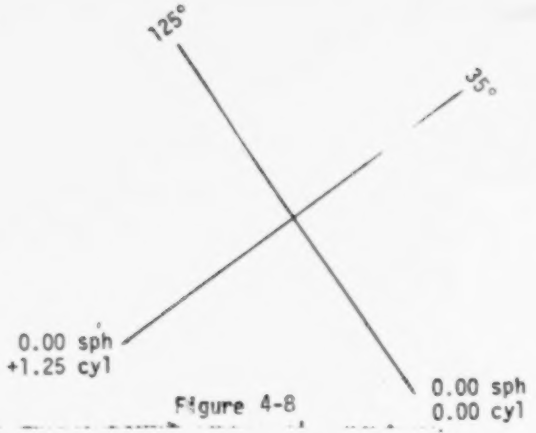


Figure 4-8

The drawing of a cross and labeling the appropriate meridian is called an OPTICAL CROSS; an entire section of this SW is devoted to the subject. The basic principles of cylinder axis, power, spherocylindrical power etc. are all applied when "Optical crossing" an Rx.

CYLINDER FORMS. You've already seen that ophthalmic lenses are made in the meniscus form with a plus front surface and minus back surface, and that spherocylinders have a spherical surface (1 curve) and a toric surface (2 curves). This toric surface can either be on the front or back. When a lens is ground with the toric surface on the plus or front surface, we say the lens is ground in PLUS CYLINDER FORM. On the other hand, if the toric surface is on the back or minus surface we say the lens is ground in MINUS CYLINDER FORM. When writing a prescription, the sign of the cylinder dictates the form of the prescription. When the cylinder is plus, it is written in plus cylinder form and vice versa.

For example, the prescriptions

-1.00 + 0.50 X 010 (Plus cylinder) and -0.50 - 0.50 X 100 (Minus cylinder)

look different but when placed on a optical cross we find that the end result is the same. The optical cross of -1.00 + 0.50 X 010 looks like the one in Figure 4-9.

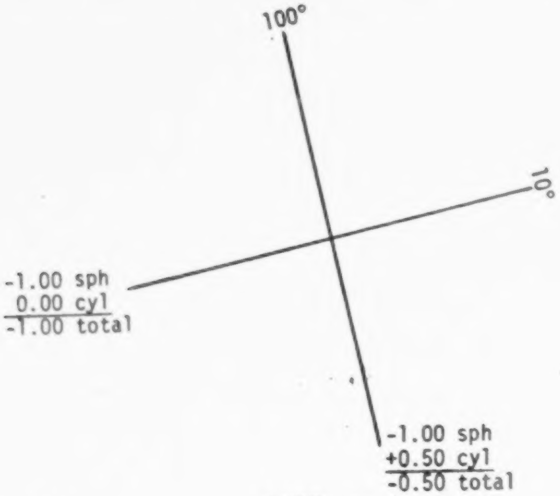


Figure 4-9

and the optical cross of -0.50 - 0.50 X 100 looks like this: (Figure 4-10)

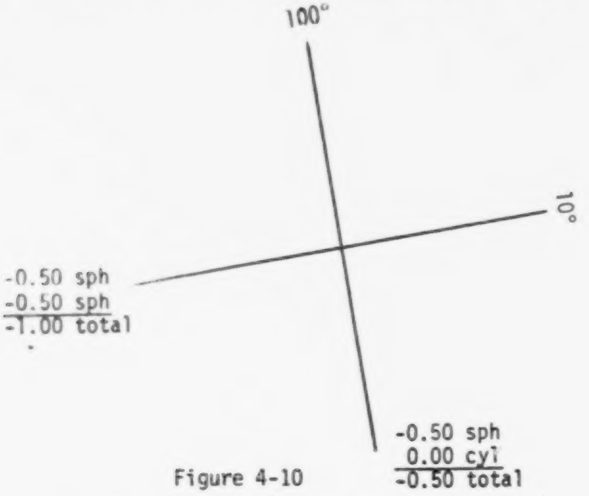


Figure 4-10

Notice that the total power in the 10° meridian is -1.00D in both examples, and the total power in the 100° meridian is -0.50D. These lenses are the same, although the written prescription may be in either plus or minus cylinder form. There are ways of converting between plus and minus cylinder forms and they will be covered near the end of this block. In the meantime remember a lens Rx may be written in either plus or minus cylinder form. If the toric surface is on the front it is in PLUS CYLINDER. conversely, if the back surface is toric, the lens is ground in MINUS CYLINDER.

You should understand from our discussion of various ophthalmic lenses that whether a patient receives a spherical, cylindrical, or spherocylindrical prescription depends on the power they require in each meridian. You should understand that a sphere is used when a patient requires equal power in all meridia. A cylinder is used when a patient needs power in one meridian and no power in the other (axis) meridian. A spherocylinder is required when a patient requires different powers in the major meridia.

MULTIFOCAL LENSES. A multifocal lens is, just as the name implies, a lens with more than one focal length. They're usually prescribed for people who have lost their ability to focus at near and require more plus power for close work. A lens with an additional segment is called a bifocal, and one with two additional segments is a trifocal.

It was mentioned earlier in the block, that the two major factors influencing lens power were index of refraction and surface curvature. Thus we have two major categories of multifocals: those that increase the index of refraction of the segment(s) (FUSED MULTIFOCALS), or those that increase the plus surface curvature of the segment(s) (ONE-PIECE MULTIFOCALS). Most multifocal lenses have the additional segment(s) either fused into or ground onto the front (plus) surface.

The fused multifocal uses a higher index of refraction glass, fused into the carrier lens at high temperature, to achieve the additional plus power. Shown in Figure 4-11 is a side vide of a fused bifocal.

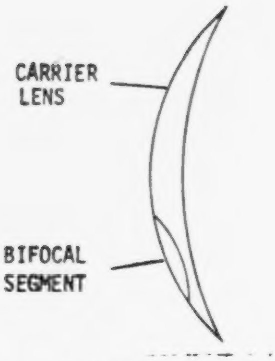


Figure 4-11

The one-piece multifocal uses increased curvature of the front (+) surface to supply the additional plus power to the additional segments. This is depicted in Figure 4-12.

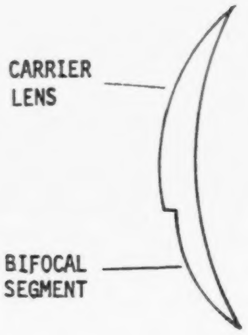


Figure 4-12

Types and styles of multifocals will be discussed later in the course. At this time, it's important for you to realize that there are only two major categories of multifocals-fused and one-piece . Both of these give additional plus power when the patient looks through the segment(s). Thus the notation for bifocals is "Add +1.75" or "add +2.50." A lens prescription for bifocals then would usually look like this:

EXAMPLE 1: O.D. -1.00 - 0.50 X 095
O.S. -1.25 - 0.75 X 070
Add +1.75 O.U.

EXAMPLE 2: O.D. +2.00 sph
O.S. +1.75 sph
Add +2.25 O.U.

The patient will still use his distance Rx when he looks through the bifocals, however he will also use, in addition to that Rx, the spherical add power prescribed by the optometrist.

Trifocal notation is very similar to bifocal notation except that the additional power of the intermediate segment is given as a percentage of the bifocal add power. For example:

O.D. +0.75 + 1.00 X 034
O.S. +1.00 + 1.00 X 144
Add +2.00 O.U./50% intermediate

means that the patient will have +2.00D additional sphere power through the bifocal and +1.00D additional sphere power through the trifocal. Remember that the total power through the bifocal or trifocal is the combined power of the carrier lens Rx and the additional power provided by the segment. Thus adding the bifocal addition algebraically to the distance sphere power will provide the total power through the bifocal. Adding 1/2 of the bifocal add to the distance sphere will give the total power through the intermediate segment of a 50 percent trifocal.

OPTICAL CROSS

You learned in refractive qualities of ophthalmic lenses that spherocylinders have two major meridians 90° apart. Diagramming these two power meridians and labeling the power meridians from a prescription is called an OPTICAL CROSS.

Diagramming the Optical Cross

To draw an optical cross look at the axis given in the Rx, draw a line indicating that meridian, and label it on one side. Perpendicular (at right angles) to this meridian draw the other meridian and label it. For example the meridians for + 1.00 - 2.00 X 180 are drawn as follows: (Figure 4-13)

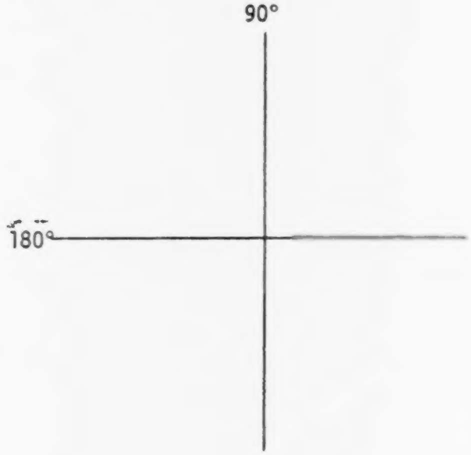


Figure 4-13

To label the cross with the prescription: +1.00 - 2.00 X 180 observe that the sphere power is +1.00. This means that there is +1.00D of power in all meridians so we label the sphere power in both meridians as shown. (Figure 4-14).

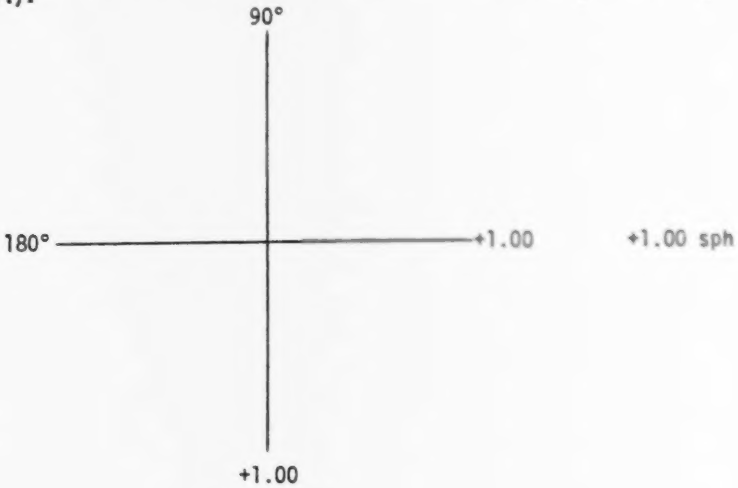


Figure 4-14

The second element in the prescription is the cylinder power. We know that the cylinder has ZERO POWER ALONG ITS AXIS AND MAXIMUM POWER 90° AWAY. Keeping this in mind observe that in +1.00 - 2.00 X 180 the axis is 180° so write 0.00D in the 180° meridian and the full power of the cylinder (-2.00D) 90° away in the 90° meridian. (Figure 4-15)

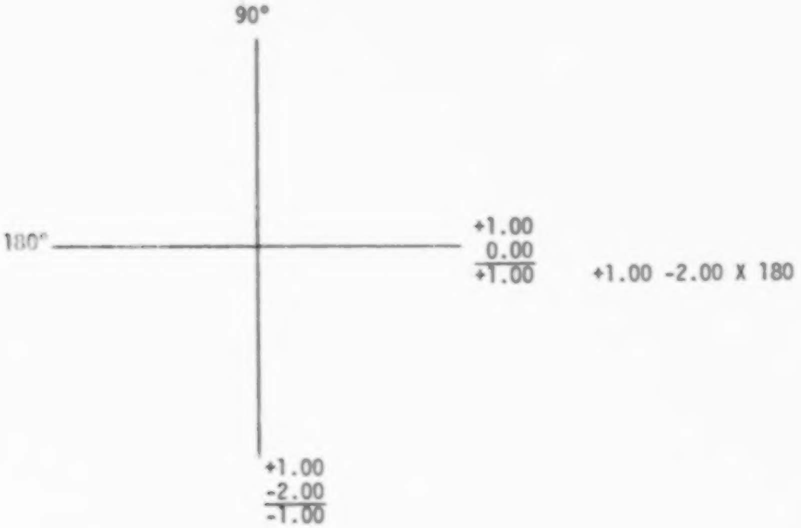


Figure 4-15

Algebraically adding the power in the 90° meridian gives -1.00D total power in that meridian. The 180° meridian does not receive any cylinder power because it is the axis meridian and only contains the +1.00D of sphere power.

To illustrate further some examples are given with the diagrams completed. Study these well as the concept of optical cross is extremely important.

EXAMPLE 1: +1.00 + 1.50 X 135 is diagrammed on an optical cross as (Figure 4-16)

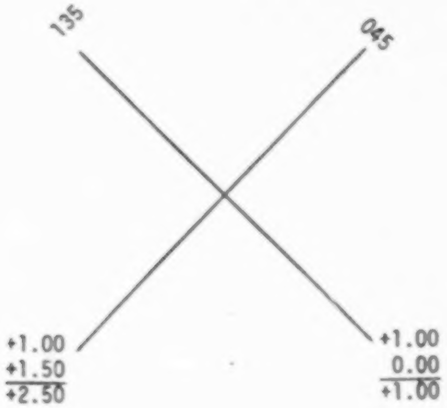


Figure 4-16

EXAMPLE 2: Pl -1.25 X 027 - notice that this lens has no sphere power and so is called a cylinder not a spherocylinder. (Figure 4-17)

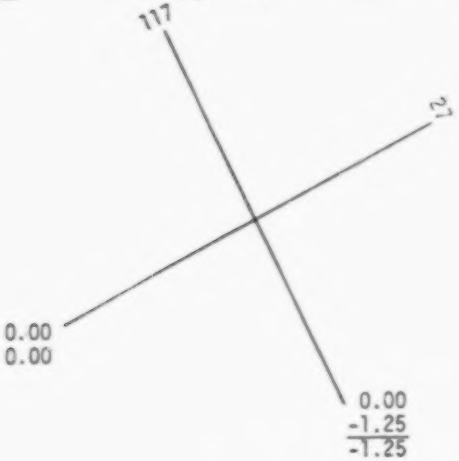


Figure 4-17

EXAMPLE 3: -4.75 +2.25 X 155. (Figure 4-18)

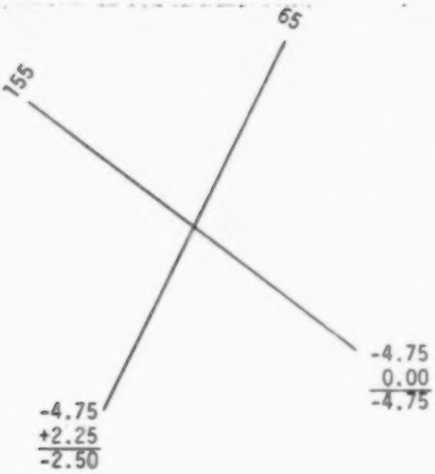


Figure 4-18

Once again remember that sphere power is in all meridians, but a cylinder does not contribute any power to the axis meridian. Its maximum power occurs 90° away from the axis meridian.

Optical Cross Transposition

Suppose that you are not given the prescription but instead given the optical cross with the total power in each meridian. You can derive the Rx in either plus or minus cylinder form in the example on the next page.

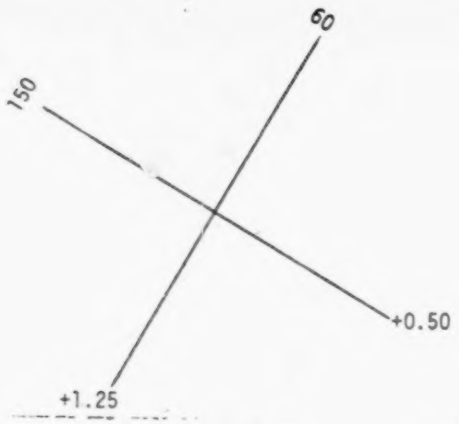
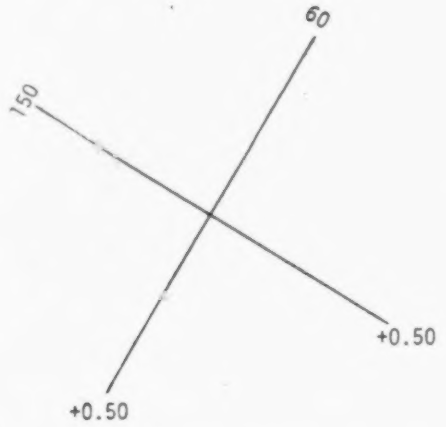


Figure 4-19

Observe in figure 4-19 that only the total power is given. To obtain a prescription select one of the powers and make it your sphere power. Let us say +0.50. You are then saying that you have +0.50D in every meridian as shown. (Figure 4-20.)



+0.50 sph

Figure 4-20

The 150° meridian is accurate with +0.50D of power, but there is supposed to be +1.25D in the 60° meridian, so an extra +0.75 is required in this meridian. To produce an additional +0.75D of power in the 60° meridian, a +0.75 cylinder with axis at 150° is used. Combining this together gives

+0.50 + 0.75 X 150

This Rx is in PLUS CYLINDER form because the sign of the cylinder is plus. Had the prescription been desired in minus cylinder, the +1.25D should have been selected as the sphere power and then the Rx would read

+1.25 - 0.75 X 060.

RULES

1. IF THE Rx IS DESIRED IN MINUS CYLINDER FORM SELECT THE MOST PLUS/LEAST MINUS POWER MERIDIAN AND MAKE THIS THE SPHERE POWER OF THE Rx.

2. IF THE Rx IS DESIRED IN PLUS CYLINDER FORM SELECT THE MOST MINUS/LEAST PLUS POWER MERIDIAN AND MAKE THIS THE SPHERE POWER OF THE Rx.

Transposing or changing the Rx from one cylinder form to the other may be done using the optical cross method. Suppose you are given: -1.50 - 2.00 X 045 and you desire the Rx in plus cylinder form. First diagram the Rx on an optical cross as shown (Figure 4-21).

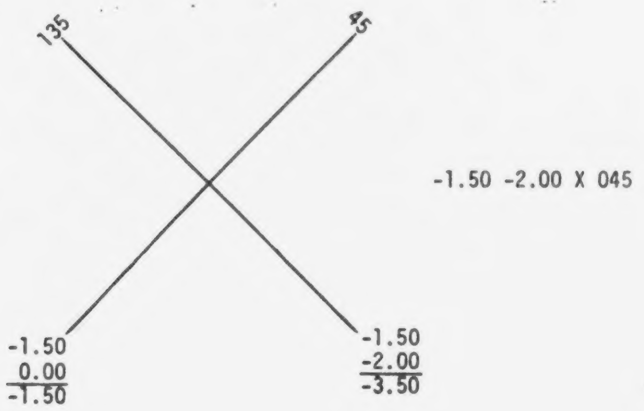


Figure 4-21

Now choose the most minus/least plus power meridian and make this the new sphere. In this case -3.50 is most minus. The 45° meridian should not have -3.50 of power it should have -1.50. The 45° meridian requires a +2.00 D of cylinder power so we make the 135° meridian the axis. Remember cylinder power is always 90° away from the axis. By doing this we have the Rx in (+) cylinder form as:

-3.50 +2.00 X 135

As a cross-check this Rx can be diagrammed to verify that the meridians do have the same power. This is shown below

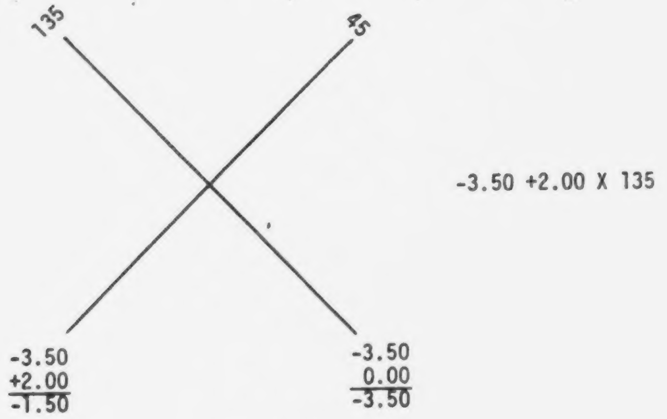


Figure 4-22

Some further examples of optical cross transposition are given for you to study.

EXAMPLE 1: Using the optical cross method transpose +0.50 -1.25 X 070 to plus cylinder form.

Diagramming the Rx gives:

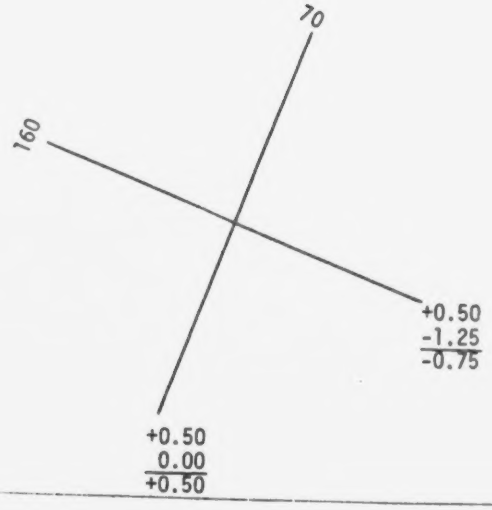

70
160
+0.50
-1.25
-0.75
+0.50
0.00
+0.50

Figure 4-23

Selecting the most minus/least plus power as the new sphere gives: -0.75 sph

But the 70° meridian should have +0.50D so we add +1.25D of power to it by combining the -0.75 sphere with +1.25 cylinder axis 160° to produce the desired +0.50D of power in the 70° meridian. The complete Rx is:

-0.75 +1.25 X 160

and as a cross-check may be diagrammed as shown below

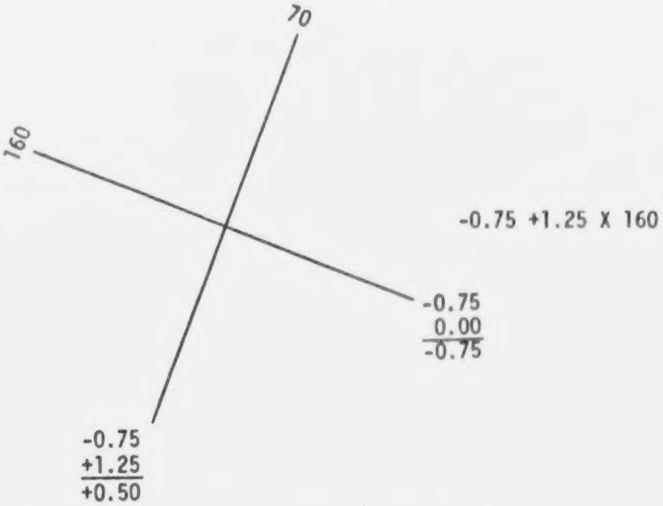
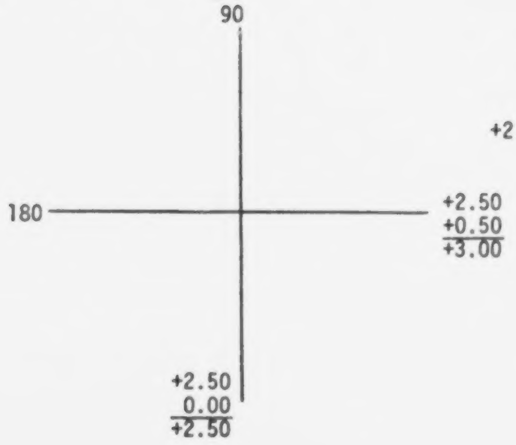

70
160
-0.75 +1.25 X 160
-0.75
0.00
-0.75
-0.75
+1.25
+0.50

Figure 4-24

EXAMPLE 2: Using the optical cross method transpose +2.50 +0.50 X 090 to minus cylinder.

Diagramming the Rx gives:


90
180
+2.50
+0.50
+3.00
+2.50
0.00
+2.50

+2.50 +0.50 X 090

Figure 4-25

Selecting the most plus/least minus power as the new sphere gives +3.00D as the new sphere. However, the 90° meridian should not have +3.00D it should have +2.50D so in addition to the +3.00 sphere a -0.50 cylinder with axis at 180° is required. Thus the Rx in minus cylinder form is

+3.00 -0.50 X 180°

which diagrams as:

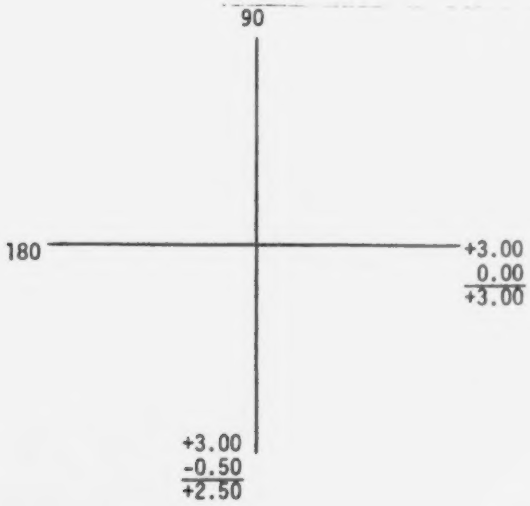

90
180
+3.00
0.00
+3.00
+3.00
-0.50
+2.50

Figure 4-26

Showing that the total power in each major meridian remains unchanged by the cylinder form that the Rx is written in.

SPHERICAL EQUIVALENTS

At times in our Air Force optometry clinics, we are faced with a patient who comes in with no servicable glasses because he/she has just broken or lost his/her last pair. When ordering new glasses from the military optical lab, we are confronted with at least a two week fabrication time. In order to give the patient something to use as a temporary measure until the newly ordered glasses are received, we can use a spherical equivalent prescription. A spherical equivalent lens is a spherical lens used as a temporary replacement for a spherocylindrical prescription. The method of calculating the spherical equivalent from the spherocylindrical prescription is accomplished in two steps:

1. Take one half of the cylinder power.

   For example: OD -5.00 -2.00 x 090. One half of the cylinder power (-2.00) is -1.00.

2 Add this power algebraically to the sphere.

   In our example, the sphere is -5.00, so: $\begin{array}{r} -5.00 \\ \underline{-1.00} \\ -6.00 \end{array}$ sphere

A -6.00 diopter sphere in the right lens would be a satisfactory temporary lens for this patient.

A stock of spherical lenses can be accumulated in our optometry clinics from spectacles that patients have never picked up, or old glasses they've turned in. They may also be ordered from the optical labs.

Physiologically, what we are doing when we calculate the spherical equivalent lens is placing the astigmatic patients' circle of least confusion on or near the retina. In our example, OD -5.00 -2.00 x 090, the patient is a compound myopic astigmat and has both meridians focusing in front of the retina. (Figure 4-27).

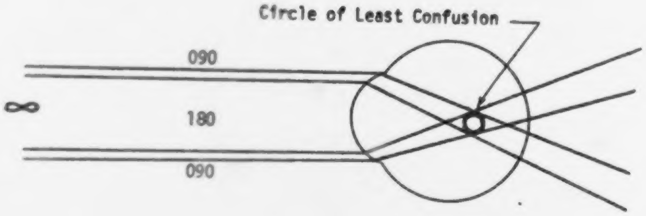


Figure 4-27

The circle of least confusion is in front of the retina.

With the spherical equivalent prescription of -6.00 sphere, the circle of least confusion is on the retina. (Figure 4-28).

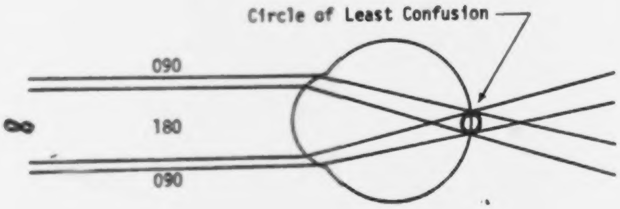


Figure 4-28

ABERRATION IN LENSES. There are five inherent aberrations in ophthalmic lenses we will discuss. They are:

1. Chromatic aberration.
2. Marginal or oblique astigmatism.
3. Curvature of field
4. Spherical aberration.
5. Distortion

A discussion of each of these inherent lens faults will show which of them can be ignored by the lens designer, and which ones must be taken into account when designing a specific lens.

Chromatic Aberration. We've already discussed the fact that prisms DISPERSE or break down light into its component colors. Lenses also disperse light, to some extent, due to their similarity to prisms. This dispersion of light by lenses is called CHROMATIC ABERRATION, and is illustrated in figure 4-29.

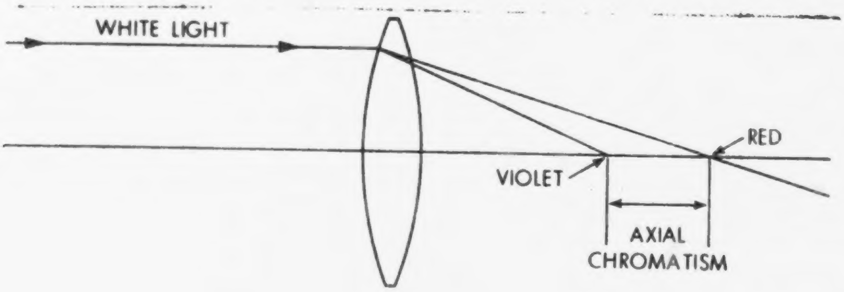


Figure 4-29

In ophthalmic corrections, except those with strong plus power bifocals, this color aberration may be disregarded.

Marginal (Oblique) Astigmatism. Marginal astigmatism is due to the fact that light rays striking a lens obliquely or at an angle are refracted differently in the vertical than the horizontal plane.

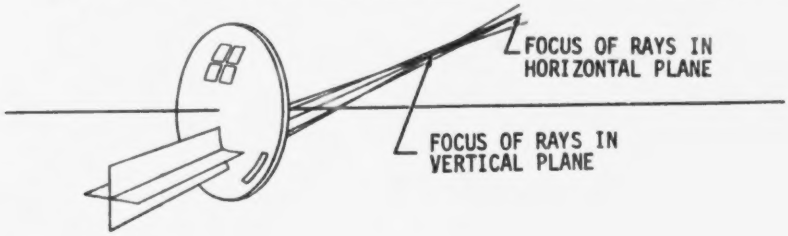

FOCUS OF RAYS IN HORIZONTAL PLANE
FOCUS OF RAYS IN VERTICAL PLANE

Figure 4-30

By altering lens curvatures, and at the same time maintaining the lens power wanted, lens designers may eliminate this marginal astigmatism. The two image points, vertical and horizontal, may be brought together in one image point.

Curvature of Field. By proper choice of lens curvatures for any closely associated range of power, marginal astigmatism is removed,and one curved image surface is obtained. The image formed in the eye does not always coincide with the various positions of the eye. This if Far Point Sphere. This difference is the lens aberration known as CURVATURE OF FIELD.

Curvature of field is the variation of the image surface (retina) from a plane surface.

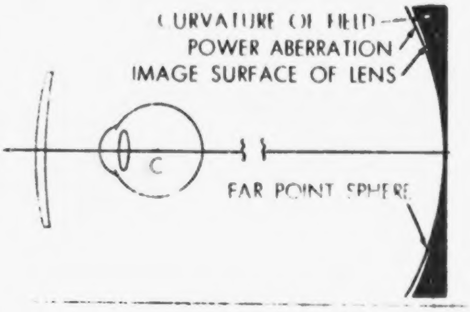


Figure 4-31

Translated, the discrepancy between the image field and far point sphere calls for small amounts of accommodation when looking obliquely through plus lenses, and a small amount of relaxation of accommodation through minus lenses. Since, at distance, the relaxed eye cannot further relax accommodation, some slight discrepancy in image quality for oblique looking directions results. In other words a patient may complain that straight lines appear curved or round plates appear to be oval. The brain will get used to this eventually.

To correct an ophthalmic lens for marginal astigmatism and curvature of field, lens designers vary the lens designs and curvatures and come up with the CORRECTED CURVE LENS.

A corrected curve lens compensates as much as possible for:

1. Marginal or oblique astigmatism.

2. Curvature of field.

Spherical Aberration. We know that, theoretically, a spherical lens should focus all parallel light rays at one single focus. In actual fact, this is not the case. Note in the diagram below that the rim rays are focusing before the paraxial rays, thus producing a blur instead of one single point focus.

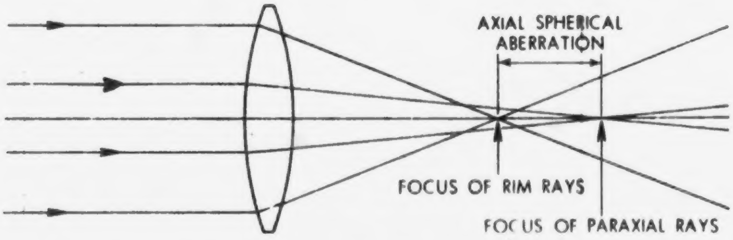
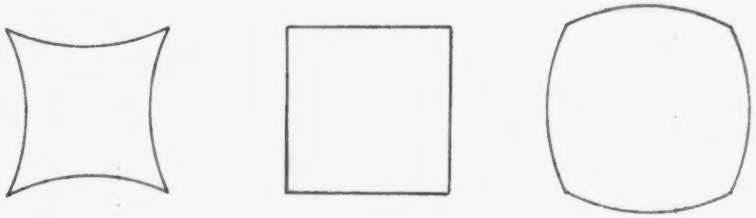


Figure 4-32

Ophthalmic lens designers do not have to worry about spherical aberration because the pupil of the eye limits the pencil of rays to a small area. This prevents the eye from seeing both rim and paraxial rays at the same time.

Distortion. Gradually increasing or decreasing magnification, as the eye looks farther and farther from the lens center, produces DISTORTION. Excessive increase in deviation of a light ray toward the lens margin accounts for this aberration. A square appears like a pincushion with plus lenses and barrel shaped with minus lenses. See Figure 4-33. The problems of distortion are very much like curvature of field.



PINCUSHION EFFECT (Plus Lens) NO DISTORTION BARREL EFFECT (Minus Lens)

Figure 4-33

Distortion cannot be eliminated in simple spectacle lenses, But in the average prescription, it is of no consequence and the critical observer can soon disregard the fault. Patients wearing strong corvex, concave, or large prescription goggle lenses must learn to disregard the curved appearance of straight lines, and the apparent motion of objects as the head is moved while fixation is maintained. In a short time, experience will overcome appearances. Fortunately, distortion is reduced with the lens curvatures selected for marginal astigmatic corrections.

EXERCISE 1-4a

INSTRUCTIONS

Complete the following statements associated with the refractive qualities of lenses.

1. The first authentic record of the use of lenses was made by ________________________.

2. The inventor of the bifocal was ___________________________________.

3. The most common ophthalmic lenses are of the ________________________variety.

4. The two major categories of lenses are __________________and ___________________________.

5. A lens that has equal power in all meridians on both surfaces is a ____________________________.

6. Right eye is abbreviated as ____________, left eye as ________________, and both eyes as ___________.

7. A simple cylinder lens has maximum power in one meridian and ______________power in the meridian 90° away.

8. A spherocylinder forms a figure called_______________________________.

9. Since a spherocylindrical lens is a combination of a sphere and a cylinder, its prescription is denoted the same way. The first element is the ___________power, the second element the_______________ power, and the third element the ______________________.

10. A ____________lens has two or more primary foci.

11. A spherical lens used for a temporary replacement of a spherocylindrical correction is called a ____________________________________.

12. The five most common types of lens aberrations are _______________________, _______________________, _______________________, _______________________, and __________________________.

Place the following lens prescriptions on an optical cross.

1. -0.50 +3.00 X 044

2. +1.50 +1.50 X 132

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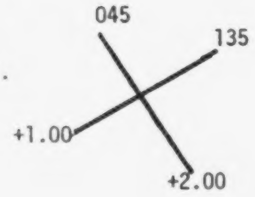
3. -6.50 -3.25 X 059

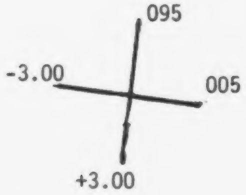
Using the following optical crosses, derive the Rx in the cylinder form requested.

1.


045
135
+1.00
+2.00

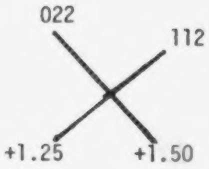
plus (+) cylinder form: ______________________________.

2.


095
-3.00
005
+3.00

minus (-) cylinder form: ______________________________.

3.


022
112
+1.25
+1.50

minus (-) cylinder form: ______________________________.

Compute the spherical equivalent of the following spherocylindrical corrections.

1. +4.00 -1.00 X 045 = ______________________________.

2. -3.00 -2.50 X 033 = ______________________________.

3. +3.50 +2.50 X 165 = ______________________________.

4. +1.00 -3.00 X 180 = ______________________________.

5. -2.00 +4.00 X 066 = ______________________________.

MATHEMATICAL TRANSPOSITION

OBJECTIVE

Given WS J3ABR91235 000-1-4b, transpose 10 eyewear prescriptions with 80% accuracy

In the last section, you learned how to transpose using the optical cross. This method is very important and will be useful later in the course when you study the lensometer, and instrument for measuring lens power. In the clinic, you will be transposing every day, and the optical cross method is slow and tedious, therefore a mathematical method of transposition was devised. It consists of the following three steps:

1. ALGEBRAICALLY ADD THE CYLINDER TO THE SPHERE AND RECORD AS THE NEW SPHERE.

2. CHANGE THE SIGN OF THE CYLINDER AND RECORD AS THE NEW CYLINDER.

3. CHANGE THE AXIS 90° AND RECORD AS THE NEW AXIS. (Remember - axes run from 001° to 180°. There is no axis greater that 180° and 000° is written as 180°.)

Some examples of this method are:

1. +1.50 -2.00 X 090 (minus cylinder)
Transposed

2. -0.50 +2.00 X 180 (plus cylinder)

1. +1.25 +1.00 X035 (plus cylinder)
Transposed

2. +2.25 -1.00 X 125 (minus cylinder)

1. -4.75 -1.25 X 105 (minus cylinder)
Transposed

2. -6.00 +1.25 X 015 (plus cylinder)

Exercise 1-4b

Transpose the following Rx's to the opposite cylinder form.

1. +1.00 -1.25 X 090

2. +2.25 +2.00 X 180

3. -3.00 -2.00 X 070

4. -3.25 +2.25 X 160

5. +2.75 -3.25 X 135

6. +1.25 +3.00 X 172

7. -2.12 -3.00 X 015

8. -2.25 +3.75 X 045

9. +0.75 -3.50 X 117

10. +0.50 +0.50 X 132

CONVERTING MULTIFOCAL Rx's TO NEAR OR INTERMEDIATE Rx's

OBJECTIVE

Given WS J3ABR91235 000-I-4c, convert 10 multifocal eyewear prescriptions with 80% accuracy.

Bifocal to Near Only Prescriptions

When light reflects off an object it is divergent until about 20 ft (clinically). Thus people require additional plus power to neutralize the minus light rays from a nearpoint object. People under age 40 can usually make this change inside the eye. However, the aging process reduces this ability. At approximately 40 years of age most people will require additional plus power to assist them in focusing near objects. These prescriptions are usually written in the form:

O.D. -1.00 -0.50 X 050
O.S. -0.75 -0.75 X 130
Add +2.00 O.U

With the Add +2.00 being additional power in the bifocal segment. Understand that when looking through the bifocal the patient receives the distance correction AND the bifocal add.

Certain patients prefer to have single vision lenses for near only, this gives them a larger viewing field. The prescription is a combination of the add power and the distant Rx and is obtained by: ALGEBRAICALLY ADDING THE BIFOCAL ADD POWER TO THE SPHERE POWER IN THE DISTANCE Rx. This is the same total power received when the patient looks through the bifocal segment. It just puts this power in a single vision lens for near only giving the patient a larger field of vision. Some examples of conversions from the bifocal Rx to near only Rx are shown below:

EXAMPLE 1: Bifocal prescritpion O.D. -1.00 -0.50 X 050 Distance Rx
O.S. -1.25 -0.75 X 130
Add +2.00 O.U Bifocal Addition

To obtain the near Rx add +2.00 to both sphere powers and make this value the new sphere. The right eye sphere will be -1.00 +2.00 = +1.00 and the left eye sphere will be -1.25 +2.00 = +0.75 giving us a near prescription of

O.D. +1.00 -0.50 X 050
O.S. +0.75 -0.75 X 130

Trifocal to Near or Intermediate Only

This is performed in the exact manner as the conversion of a bifocal to a near only Rx. The add is algebraically combined to the sphere portion of the Rx.

Converting a trifocal to an intermediate Rx is similar. We now want a single vision lens that equals the power in the intermediate segment. The intermediate segment is usually given as a percentage of the near e.g. 50%. In this case 50% of the bifocal add power is added to the sphere to make an intermediate Rx.

EXAMPLE: +2.50 -0.50 X 060
+3.00 -0.75 X 120
+2.00 add with 50% intermediate segment

To convert to an intermediate Rx, add 50% of the +2.00 power to the sphere power of each eye. 50% of +2.00 = +1.00. The intermediate single vision Rx would be:

+3.50 -0.50 X 060
+4.00 -0.75 X 120

Since all of our glasses are ordered in -cyl form, transposition may be required. DO NOT CONFUSE THE STEPS. Do one thing at a time.

Exercise 1-4c

Derive the near Rx from the following bifocal Rx's:

1. O.D. -3.00 sph
   O.S. -2.50 sph
   Add +1.75 O.U.

2. O.D. +1.25 sph
   O.S. +0.75 sph
   Add +2.50 O.U.

3. O.D. +0.50 -1.00 X 085
   O.S. +0.25 -0.75 X 100
   Add +1.50 O.U.

4. O.D. -4.75 -2.25 X 035
   O.S. -5.25 -2.00 X 140
   Add +1.25 O.U.

5. O.D. Pl sph
   O.S. Pl -0.75 X 180
   Add +2.00 O.U.

BASE CURVES

OBJECTIVE

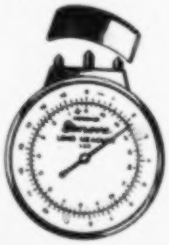
Given a lens clock and WS J3ABR91235 000-1-4d, measure the base curves of 12 pairs of spectacles. At least 9 must be to an accuracy of ± 0.25 Diopters.

The Lens Clock

The lens clock (lens measure, lens gauge), is designed to measure the curvature of lens surfaces in diopters. This instrument is used to measure the base curve (B.C.)of lenses to insure proper duplication of certain spectacle prescriptions.

Before you use the lens clock, remember that it is a delicate instrument. Treat it gently. The small cap at the top of the instrument (Figure 4-34), protects the three measuring posts. The separation of these posts from each other as well as their relative heights is critical. Protect them by keeping the cap on at all times when the instrument is not in use.

MEASURE, LENS, OPHTHALMIC



Lens clock. Graduated in 1/4 diopter steps to plus and minus 17.00 diopters.

Action	Index No.	National Stock No.	Descriptive Data
—	17460	6540-00-261-7238	Geneva Improved

Figure 4-34

As you hold the lens clock, you can see that it has a large circular dial inscribed with red and black numbers. The red numbers indicate negative (-) curvature (a concave surface) and the black numbers indicate positive (+) curvature (a convex surface). These numbers represent diopters of curvature, and the instrument is capable of measuring curves from -17.00 D to +17.00 D.

Calibration

In order to measure lens curves correctly, the lens clock must be calibrated with an optically flat piece of glass. Remove the cap and place the lens clock perpendicular to the surface of the glass. The lens clock should be grasped around its circumference, with the index finger and thumb pointing toward the posts. The middle finger of the same hand can be used as a brace and further support the lens clock. Be sure to keep the lens clock perpendicular to the surface of the glass at all times. If the lens clock is in adjustment, the three posts will be exactly the same height, and the pointers will indicate zero (0) diopters. If the clock does not indicate 0 diopter, it must be recalibrated.

Using the Lens Clock

Once the clock is calibrated, you may use it to measure the surface curves of a lens. If you are right-handed, hold the lens clock in your right hand as described above. Grasp the lens in your left hand. Place the posts of the lens clock against the lens face, the same way you "clocked" the optical flat --keeping it perpendicular to the lens surface. Watch the pointer. If the surface is spherical, the pointer will indicate only one value as the clock is rotated. If it is cylindrical, the pointer will fluctuate and have a maximum and minimum reading when the clock is rotated. When you clock the front surface of a lens, the curve(s) will be read on the black scale. When you clock the back surface of the lens, the curve(s) will be read on the red scale. You can algebraically add the front and back surface curves to obtain the approximate total power of the lens. Remember, use the black (+) scale on the front (convex) surface and the red (-) scale on the back (concave) surface.

Definition of the Base Curve

After you have measured the lens surface curves in the above manner, your next step is to determine which of the curves is the base curve. The base curve may be located as follows:

1. Single vision glass spheres: The base curve is the weaker curved surface.

2. Single vision glass spherocylinders: The base curve is the weakest curve on the toric surface for plus cylinders. Use the spherical front surface as the base curve for minus cylinders.

3. Multifocal glass lenses: The base curve is the spherical curve on the side containing the segment(s). (This is usually the front surface.)

4. Plastic single vision lenses: The base curve is the front surface curve.

5. Plastic multifocals: The base curve is on the side containing the segment.

SUMMARY

In summary, remember that the main purpose of the lens clock (lens measure, lens gauge) is to measure the base curve of a lens. The doctor will sometimes wish to order a certain base curve in order to minimize patient adaptation , so you will have to know which curve is the base curve in order to verify the prescription. The base curve is a fixed curve ground on the lens blank at the factory. The other power curves are added at the finishing lab.

Exercise 1-4d

Complete the statements.

1. The instrument used to measure base curve is a ______________________________.

2. The base curve of a single vision + sphere lens is located on the ____________ surface.

3. The base curve of all other lenses is located on the ______________________ surface.

4. The base curve of a spherocylindrical lens is the ______________________ curve on the ______________________ surface.

5. Front curves are measured by reading the ____________________ numbers on the instrument, while back curves are measured by reading the ____________________ numbers.

6. Given the following information from your lens clock, list the base curve from each example:

   a. Lens a: +2.00 D, +4.00 D, -6.00 D

   b. Lens b: +8.00 D, -6.00 D
      Single vision glass

   c. Lens c: +6.25 D, -8.00 D, -7.75 D
      ST-25 bifocal glass

   d. Lens d: +6.00 D, -8.00 D
      Single vision glass

LENS NEUTRALIZATION

OBJECTIVE

Using a lensometer and WS J3ABR91235 000-1-4e, neutralize 20 lenses. At least 17 must be to an accuracy of ± 0.25 diopters.

The Lensometer

The American Optical lensometer or Bausch & Lomb Vertometer are two instruments designed specifically to determine the power of a spectacle lens. You will use one of these instruments several times a day in your clinic. Although the A.O. and B & L instruments differ slightly in appearance, the principle of operation is similar. The following information will describe the proper use and maintenance of the A.O. lensometer, but remember that it can be appled to the B & L Vertometer as well.

Description

Figure 4-35 shows the external parts of an AO lensometer. You should memorize the names and locations of all of the various parts so you can learn the proper operation of the instrument more rapidly.

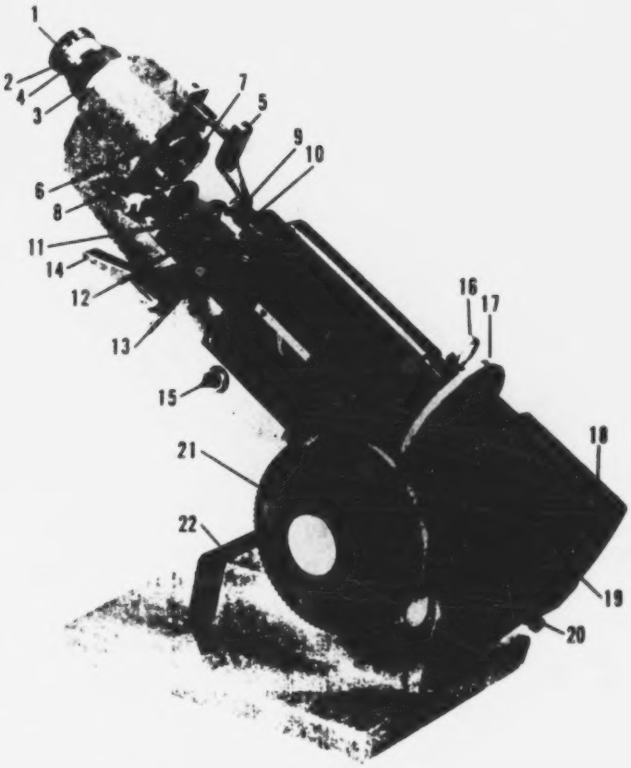


Figure 4-35

1. Focusable Eyepiece
2. Eyepiece Lockscrew
3. Prism Direction Ring
4. Eyepiece Scale
5. Lens Holder
6. Green Filter
7. Auxiliary Prism Holder
8. Lens Marker Lever
9. Gimbal Action Ring Support
10. Interchangeable Nosepieces (2) Standard Black; Contact Lens White
11. Marking Pens
12. Ink Well
13. Spectacle and Lens Table
14. Spectacle and Lens Table Raising Lever
15. ON-OFF Switch
16. Axis Wheel Magnifier
17. Axis Wheel and Scale
18. Pilot Light
19. Lamp Housing
20. Lamp Housing Thumb Screw
21. Power Wheel and Scale
22. Base Compartment

Maintenance of Lensometer/Vertometer

Every lensometer comes with its very own dust cover. It's used exactly for that, to keep dust off the eye piece and moving parts. It should always be in place when the instrument is not in use. Dust may be removed from exterior lenses with a tissue or cotton swab.

Occasionally the bulb will burn out. The only authorized maintenance you can perform in the clinic is changing the light bulb. On the AO lensometer, crank the power wheel in the minus direction to ±20.00, loosen the screw at rear of instrument, and slide the cover back. Unscrew the bulb and replace it. On the B & L Vertometer, crank the power wheel in minus direction and open slide door. The bulb is in a flip-out apparatus for easy replacement. Simply flip apparatus out, remove and replace the bulb.

Figure 4-36 shows an internal view of the lensometer. You should also memorize the names of these items since we will refer to them frequently in the following lesson.

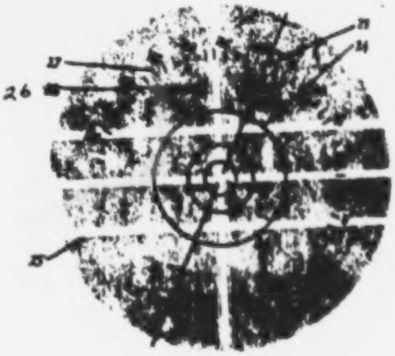


Figure 4-36

23. Prism Direction Indicator Line

24. Prism Power Rings

25. Cylinder Power Lines (Wide Target Lines)

26. Sphere Power Lines (Narrow-Wide-Narrow Comb.)

27. Prism Direction Scale

HOW TO USE THE LENSOMETER

1. Plug the instrument into a 115 VAC receptacle and check to see if the light operates correctly.

2. Once you have assured yourself that the lensometer is in working order, you must adjust it to your own eye. First, turn the focusable eyepiece fully counterclockwise. Then place a piece of white paper in front of the nosepiece. The lens holder should be rotated up and out of the way. Now look into the eyepiece. The circles and lines will be blurry.

Slowly turn the eyepiece clockwise until the circles and lines are clear. Do not turn past this point. Do not rock the focus back and forth.

Now remove the paper leaving the instrument on. You should see the bright power lines as in Figure 4-36. Turn the power drum until all of the power lines (mires) are sharp and clear. Now look at the power drum. It should read 0 diopters, exactly. If it does not read 0 diopters, repeat step 2.

3. Once the instrument is adjusted to your eye, you are ready to measure lens powers. Continue following the instructions carefully.

a. Pull back the lens holder (5) and insert the lens with its concave side against the nosepiece.

b. Release lens holder; it will extend and hold lens against nosepiece.

c. Adjust the spectacle lens table height, using lever (14), so that the lens will be approximately centered against the nosepiece when resting on the table.

d. Look into the eyepiece. If the power of the lens makes the mires (target) too blurred to center, rotate the power wheel until the target lines are in approximate focus. Raise or lower the lens and slide the lens or spectacles from side to side on the lens table until centering is achieved, as in Figure 4-36.

e. While looking into the eyepiece, rotate the power wheel (21) either away from you or towards you as required until the mires (target) come into sharp focus. If all of the lines of the target come into focus at the same time, the lens is a simple sphere.

f. Read the power of the lens on the power wheel (21). The red portion indicates minus - the black portion indicates plus. The scale is divided into 0.12 diopter steps up to plus and minus 3 diopters and in 0.25 diopter steps up to plus and minus 20 diopters.

4. Reading the power of a spherical lens is probably the easiest task to perform with the lensometer. However, since most lenses are spherocylindrical, you will have to perform a little more complicated maneuver to neutralize or measure the power of these lenses.

Remember - spherocylindrical lenses may be ground in either plus cylinder form or minus cylinder form. The following explanation will describe how to neutralize any lens.

a. Insert and center the lens.

b. Turn the top of the power wheel toward you until all mires are blurry.

c. Start turning the top of the power wheel away from you until the first set of lines comes into focus. You may have to use the axis drum at this time to rotate the target to insure that the lines are straight and continuous (Figure 4-36). When it is off axis, the lines are not continous.

d. If the sphere lines are in focus, you are doing OK and may continue.

e. If the cylinder lines are in focus, turn the axis wheel 90 degrees and the sphere lines will come into focus.

f. Refine the focus of the sphere lines with the power drum and the axis alignment with the axis wheel.

g. Record the power drum readings, leave a space and record the axis.

h. Now rotate the power drum so the cylinder lines are clear. DO NOT MOVE THE AXIS DRUM!

i. Record the direction and amount of travel from the clear sphere lines to the clear cylinder lines. The direction should have been toward higher minus (or lower plus). This means you are neutralizing in minus cylinder form. The amount of travel between the two clear foci represents the cylinder power. REMEMBER, THE CYLINDER POWER IS NOT THE READINGS WHEN THE CYLINDER LINES ARE CLEAR, BUT THE AMOUNT OF TRAVEL FROM CLEAR SPHERE LINES TO CLEAR CYLINDER LINES. This cylinder sign and power should be recorded in the space left in step 4g.

5. One other way to compute the Rx is to draw an optical cross. Each arm of the optical cross is represented by either the sph or cyl mires in the lensometer. Simply labeling the optical cross arms with total powers of their respective meridians (as shown on the power drum) will enable you to determine the Rx of any lens.

6. The Rx may also be neutralized in plus cylinder form. When you check Rx's in the clinic, it is usually better to always neutralize the lens in minus cylinder form.

7. Bifocals

There are two methods to measure the power of bifocal additions.

a. The Practical Method. This method is commonly used for all types of bifocal lenses in the lower power range.

(1) Insert and center the lens with the concave surface towards the nosepiece.

(2) Take a power reading of the distance portion, in minus cylinder form.

(3) After taking a reading on the three cylinder target lines, bring the three sphere power lines back into focus. The power wheel reading is the power of the spherical portion of the lens.

(4) Raise the lens using the spectacle table raising lever (14) until the bifocal segment is over the nosepiece of the instrument.

(5) Refocus until the three sphere power lines come into clear, sharp focus.

(6) The difference between this reading and the reading on the distance spherical portion of the lens is the power of the bifocal addition. The power of the bifocal addition is not the reading of the power wheel through the bifocal.

b. The Exact Method. This is used for higher power bifocal lenses.

(1) After measuring the distance prescription with the concave surface against the nosepiece (10), place the convex side of the lens toward the nosepiece.

(2) Bring distance sphere into focus and take a power reading.

(3) Take a power reading through segment.

(4) The difference between the two is the add . Occasionally, the prismatic effect of the lens and segment will bend the light so that it does not enter the objective end of the telescope. When this happens, insert a prism of sufficient power into the auxilliary prism cell and rotate it until the target comes into the field of view.

Exercise 1-4e

You obtain the following readings with a lensometer. Write them as a complete prescription in minus cylinder form.

a. Sphere line in focus at black 1.00
Cylinder lines in focus at black 0.50
Axis reading at 095
Single vision glass

b. Sphere line in focus at black 1.25
Cylinder lines in focus at red 1.00
Axis reading at 180
Single vision glass

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c. Sphere line in focus at red 2.00
Cylinder lines in focus at red 3.00
Axis reading at 135
Single vision plastic

d. Sphere line in focus at red 2.50
Cylinder lines in focus at red 3.00
Axis reading at 095
Single vision plastic

e. Sphere line in focus at red 1.00
Cylinder lines in focus at red 1.00
Axis setting at 005
St-25 bifocal - sphere line in focus at 0.00

f. Sphere line in focus at black 1.00
Cylinder lines in focus at black 1.00
Axis setting at 005
ST-25 bifocal - sphere line in focus at black 2.00

g. Sphere line in focus at black 3.00
Cylinder lines in focus at black 1.00
Axis setting at 165
ST-25 bifocal - sphere line in focus at black 4.50

h. Sphere line in focus at red 1.25
Cylinder lines in focus at red 2.00
Axis setting 140
ST-25 bifocal - sphere line in focus at black 1.00

i. Sphere line in focus at red 2.50
Cylinder lines in focus at red 3.25
Axis setting 180
ST-25 bifocal - sphere line in focus at red 0.50

j. Sphere line in focus at black 1.00
Cylinder lines in focus at 0.00
Axis setting 030
Single vision glass

k. Sphere lines in focus at black 1.50
Cylinder lines in focus at red 0.25
Axis setting at 105
ST-25 trifocals - sphere line in focus at black 2.50 and black 3.50

APPENDIX A

GLOSSARY OF TERMS, ABBREVIATIONS, AND ROOTS

ABDUCENS - the sixth cranial nerve, innervates the lateral recti

ABDUCTION - the movement of the eye temporally (out)

ABERRATIONS - deviation of light rays emanating from a point source that prevents the rays of light from forming a point focus after passing through an optical system.

ACCOMMODATION - dioptric adjustment of the lens to attain maximum sharpness of retinal imagery.

ADDUCTION - the moving of the eye nasalward (in)

ADITUS ORBITA - front opening of the orbit

ADNEXA - appendages of the eye - the lacrimal apparatus, eyelids, and extraocular muscles

AFFERENT - sensory nerve fibers carrying impulses to the brain

AMBLYOPIA - reduced visual acuity not correctable by refractive means to 20/20

AMPLITUDE - the height from the crest to the mean of a light wave

ANESTHETIC - chemical substance that desensitizes the nerve endings

ANISOMETROPIA - condition of unequal refractive states for the two eyes, usually of gross proportions

ANOPSIA - defect or loss of vision from failure to use the visual capacity

ANISEIKONIA- relative difference in size or shape of the ocular images

ANTERIOR CHAMBER - chamber of the eye bound by the cornea anteriorly and posteriorly by the iris

ANTIMETROPIA - condition where one eye is myopic and the other eye is hyperopic

APEX - extreme point of any structure resembling an angle

APHAKIA - absence of the crystalline lens from the eye

AQUEOUS HUMOR - fluid that fills all of the anterior chamber and some of the posterior chamber

ASTIGMIA - condition of refraction in which rays emanating from a single luminous point are not focused at a single point by an optical system

AXONS - the part of a nerve cell through which impulses travel away from the cell body

BARREL, HINGE - metal flange or lip through which the hinge screw is inserted. Hinges are classified as to the number of barrels on both the front and temple

BASE CURVE - the standard or reference surface of an ophthalmic lens

BICONCAVE - having two concave surfaces on opposite faces

BICONVEX - having two convex surfaces on opposite faces

BIFOCAL - lens having two sections with different focal points

BINOCULAR - pertaining to both eyes

BIPOLAR CELLS - nerve cells in the retina related to the terminations of the rods and cones

BLEPHARITIS - inflammation of the lid margins

BONY ORBIT - cavity in the skull that contains and protects the eyeball

BOWMANS CAPSULE - thin membrane located between the corneal epithelium and the stroma

BULBAR CONJUNCTIVA - conjunctiva covering the anterior surface of the eyeball

CANAL OF SCHLEMM - canal for removal of aqueous humor

CANALICULI - narrow tubular passages that connect the puncta to the lacrimal sac

CARRIER LENS - any lens containing an additional segment

CARUNCLE - small fleshy mound located at the medial canthus

CATARACT - an opacity of the crystalline lens

CELLULOSE ACETATE - the type of plastic that comprises most of today's plastic frames

CELLULOSE NITRATE - highly inflammable plastic which was used in old frame styles

CENTRE OF CURVATURE - center of the circle formed by an extension of the surface

CHOROID - vascular portion of the eye between the sclera and the retina that provides nutrition to the eye

CILIARY BODY - portion of the vascular tunic between the iris and choroid. It consists of the ciliary muscle and the ciliary process.

CILIARY GLAND - sweat glands of the eyelid

CILIARY MUSCLE - the smooth muscle of the ciliary body responsible for accommodation

CILIARY PROCESS - point for attachment for the Zonules of Zinn. Also the area where aqueous humor is manufactured

COLMASCOPE - instrument for determining whether or not a lens has been hardened

CONCAVE - surface that curves inwards

CONES - specialized visual cells in the retina responsible for color vision and sharpness of vision

CONJUGATE - both eyes move together and remain parallel

CONJUNCTIVA - mucous membrane extending from the eyelid margin to the corneal limbus, forming the posterior layer of the eyelids and the anterior layer of the eyeball

CONJUNCTIVAL SAC - area formed between the lower lid and sclera when lower lid is manually lowered

CONSENSUAL REFLEX - contraction of the opposite pupil to the eye that is being stimulated

CONTUSION - injury in which the skin is not broken. Usually resulting in a bruise.

CONVERGENT - two or more light waves proceding towards a point

CONVEX - surface that curves outwards

CORNEA - transparent anterior portion of the fibrous tunic

CORNEAL ENDOTHELIUM - innermost layer of the cornea

CORNEAL EPITHELIUM - outermost layer of the cornea

CORRECTED CURVE LENS - lens that compensates for marginal astigmatism and curvature of field

CYCLOPLEGIC - drug that paralyzes the ciliary muscle preventing accommodation and also dilating the pupil

CYCLOPLEGIC (WET) REFRACTION - examination conducted with the use of a cycloplegic drug

CYLINDER - converges or diverges light to focus along one axis

CRYSTALLINE LENS - transparent, colorless body suspended between the aqueous and vitreous the function of which is to bring the rays of light to a focus on the retina

DECENTRATION - difference between the optical and geometric centers of a lens

DENOMINATOR - the term below or to the right of the line in a fraction, the term that divides

DESCEMET'S MEMBRANE - layer of the cornea located between the stroma and the corneal endothelium

DEVIATION - change in direction of a light ray as in passing through a prism

DICHROMAT - form of defective color vision requiring only two primary colors mixed in various proportions to match all other colors

DIFFUSION - scattering of light

DIOPTER- unit designating the refractive power of a lens

DIPLOPIA - double vision

DIRECT REFLEX - contraction of the pupil of the eye that is stimulated

DISJUNCTIVE - a separation whereby the eyes either diverge or converge during movement

DISPERSION - breaking up of white light into its component colors

DISTORTION - defect in a lens that causes a straight line to appear curved

DIVERGE - two or more light rays proceding away from a point

DRY REFRACTION - visual examination usually performed without the use of any ophthalmic drug

DUCTS- a tube or channel for conveying fluid

DUPLICITY THEORY - that vision is broken up into two types: photopic (cone or light vision) and scotopic (rod or darkness vision).

DYSLEXIA - condition in which letters but not words may be read, or words may be read but not understood.

EFFERENT - motor nerve fibers carrying an impulse away from the brain

EMMETROPIA - visual condition identified by the conjugate focus on the retina from infinity when accommodation is relaxed

ESOPHORIA - latent turning inward of the eye under cover when one eye is covered and fusion is not possible

ESOTROPIA - manifest turning inward of one eye whether or not one is covered

ETHMOID BONE - one of the bones forming the medial wall of the bony orbit

EXOPHORIA - latent turning outward of the covered eye when one eye is covered and fusion is not possible

EXOTROPIA - manifest turning outward of one whether or not one eye is covered

EXTORSION - twisting of the eye from the nasal axis to the superior. Clockwise, left eye - counterclockwise, right eye - when looking at the eyes

EXTRAOCULAR - pertaining to anything outside the eyeball

EXTRINSIC - pertaining to anything outside the eyeball

FACIAL NERVE - seventh cranial nerve that innervates the eyelids

FIBROUS TUNIC - outermost tunic of the eye, made up of the sclera and cornea

FISSURE - a crack in the bony orbit

FIXATE - act of directing the eye toward the object of regard

FOCAL LENGTH - linear distance between a point of reference and the focal point

FORAMEN - a hole in the bony orbit

FORNIX CONJUNCTIVA - loose fold of tissue located between palpebral conjunctiva and bulbar conjunctiva

FOVEA CENTRALIS - area in the macula lutea approximately 1.5mm in diameter where visual acuity is highest because of the high percentage of cones

FREQUENCY - the number of waves passing a fixed point in one second

FRONTAL BONE - bone that forms the anterior portion of the roof of the orbit

FUSED BIFOCAL - a bifocal lens which has added dioptric power added to it by countersinking into its surface and "additional button" of glass which has a higher index of refraction than the carrier lens

FUSION - act or process of blending or uniting two images

GANGLION CELLS - third order nerve cells of the retina. Bipolar cells synapse with ganglion cells, and axons of ganglion cells form the optic nerve.

GEOMETRIC CENTRE - physical and measured centre of a lens

GLAUCOMA - sustained increase in intraocular pressure that causes damage to the eye

HABITUAL Rx - present prescription of the patient

HABITUAL VA - visual acuity obtained with glasses if worn by the patient

HETEROPHORIA - latent tendency of the lines of sight to deviate from the relative position

HETEROTROPIA (STRABISMUS) - condition in which binocular vision is not present under normal seeing conditions

HOMEOSTASIS - the tendency to maintain normal internal stability in an organism

HYPHEMIA - hemorrage into the anterior chamber of the eye

ILLITERATE - in the optometry field this pertains to anyone who cannot discern the English alphabet

INCIDENT RAY - light ray that comes in to strike the surface of a lens or mirror

INDEX OF REFRACTION - ratio of the speeds of light in two different media

INFRARED - light waves beyond the red portion of the visible spectrum; they are longer wavelengths than visible

INFERIOR - located below or directed downward in relation to the eye

INFERIOR OBLIQUE MUSCLE - extraocular muscle that originates at the anterior medial floor of the orbit and inserts on the posterior temporal sclera

INFERIOR RECTUS MUSCLE - extrinsic ocular muscle that originates at the annulus of Zinn and inserts on the inferior sclera

INFINITY - in optical science, a term used to denote a distance so great that the rays of light from it appear parallel

INNERVATION - nerve stimulus that moves a muscle

INSERTION - in optometry, the place where an extraocular muscle attaches to the eyeball

INTERPUPILLARY DISTANCE (PD) - distance between the centers of the pupils

INTORSION - twisting of the eye from the nasal axis to the inferior. Clockwise for the right eye, counterclockwise for the left eye - when looking at both eyes

INTRAOCULAR PRESSURE - pressure of the intraocular fluid, measured with a tonometer, high pressure may indicate glaucoma

INTRINSIC - pertaining to the inside, when dealing with muscles, those located inside the eyeball

IODOPSIN - photosensitive substance in retinal cones which subserve photopic vision

IRIDECTOMY - surgical removal of part of the iris

IRIS - most anterior part of the uveal tract, consisting of a circular pigmented membrane, perforated to form the pupil

IRITIS - inflammation of the iris

ISOPTER - contour line representing the limits of retinal sensitivity to a specific test target

KERATOCONUS - thinning and stretching of the central corneal tissue producing a bulge or cone shape

LACERATE - to tear or cut jaggedly

LACRIMAL BONE - one of the bones that form the medial wall of the orbit

LACRIMAL DUCTS - ducts that receive secretions from the lacrimal gland and empty into the superiortemporal fornix conjunctiva

LACRIMAL FLUID - fluid secreted by the lacrimal gland

LACRIMAL FOSSA - vertical groove in the anterior medial wall of the orbit. It contains the lacrimal sac.

LACRIMAL GLAND - the gland, located in the anterior and superior and temporal area of the orbit, that secrets lacrimal fluid

LACRIMAL SAC - saclike structure located in the lacrimal fossa that receives tears from the canaliculi and deposits them in the nasolacrimal duct

LATENT - hidden in normal circumstances but shows under certain conditions

LATERAL - toward or pertaining to the temporal side of the eye

LATERAL CANTHUS - area where the upper and lower eyelids meet on the temporal side of the eye

LATERAL RECTUS - extraocular muscle that originates at the annulus of Zinn and inserts on the lateral portion of the sclera

LATERAL GENICULATE BODY - part of the visual system that relays nerve impulses from the optic tract through to the optic radiations

LENS CLOCK/GAUGE - device used to measure the base curve of an ophthalmic lens

LENTICULAR - ophthalmic lens of high dioptric power with prescription ground only on the central portion, the periphery is usually plano and serves as a carrier so that the lens is suitable for spectacles

LESION - injury or other change in an organ or tissue of the body resulting in impairment or loss of function

LEVATOR PALPEBRAE SUPERIORIS - extraocular muscle that originates from the small wing of the sphenoid and inserts at the skin and tarsal plate of the upper lid

LIGHT - term commonly used for radiant energy which affects our eyes and gives us vision

LIGHT PERCEPTION - ability to determine the presence of light

LIMBUS - transitional zone between cornea and sclera

LITERATE - as related to optometry, any person who can discern the English alphabet

MACULA LUTEA - oval area in the retina 3 to 5mm in diameter, located temporal to the posterior pole of the eye and slightly below the level of the optic disc. In its centre is the fovea centralis. It provides for the best photopic visual acuity.

MAGNESIUM FLUORIDE- clear coating applied to lenses to reduce reflection

MALINGER - feigning or deliberately giving false test responses to gain desired results

MALTESE CROSS - pattern seen through a colmascope indicating a hardened lens

MANIFEST - shows up even under normal circumstances

MAXILLARY BONE - bone which helps form the anterior medial wall and floor of the orbit

MEDIAL - toward or pertaining to the nasal side of the eye

MEDIAL CANTHUS - area where the upper and lower eyelids meet on the nasal side of the eye

MEDIAL RECTUS - extraocular muscle that originates at the annulus of Zinn and inserts on the medial portion of the sclara

MEIBOMIAN GLAND - series of sebaceous glands located in the tarsal plate whose ducts empty into the lid margins

MENISCUS - a lens convex on one side and concave on the other

MERIDIAN - imaginary line drawn through or from the optical centre or optical axis

MINUS LENS - lens that diverges light

MIOSIS - condition of having a constricted or very small pupil

MIOTIC - constricts the pupil (usually referring to drugs)

MONOCHROMATIC - composed of light of one colour

MONOCULAR - pertaining to one eye

MOTOR NERVE - nerve that carries an impulse from the brain to the muscle

MULTIFOCAL - lens with two or more foci due to additional segments

MYDRIASIS - condition of having a dilated or large pupil

MYDRIATIC - dilates the pupil (usually referring to drugs)

MYODISC - minus lenticular lens. High minus lens of small dimensions set into a plano carrier lens to fit it into spectacles.

MYOPIA - commonly called nearsightedness. Refractive condition of the eye represented by the location of the conjugate focus of the retina at some finite point in front of the eye, when accommodation is said to be relaxed.

N-15 - absorptive lens with 15% light transmission

N-31 - absorptive lens with 31% light transmission

NASAL - toward the nose

NASOLACRIMAL DUCT - distal portion of the lacrimal apparatus through which tears drain into the nasal cavity

NEGATIVE SCOTOMA - area of the person's visual field where he does not see anything but is not aware of this absence of vision

NEURONS - structural and functional unit of the nervous system. Consisting of the cell body, axon and one or more dendrites

NORMAL - line perpendicular to a surface at the point where light strikes the surface

NUMERATOR - term above or to the left of the line in a fraction

NYCTALOPIA - condition of night blindness

NYSTAGMUS - regularly repetitive, usually rapid and involuntary movement or rotations of the eye

OBLIQUE - slanted

OCCLUDE - block or cover an eye

OCULAR MEDIA - transparent substances of the eye through which light passes

OCULAR MOTILITY - capability of spontaneous or induced movement of the eye

OCULOMOTOR - third cranial nerve, supplies all muscles to the eye except the lateral rectus and superior oblique

OCULUS DEXTER (OD) - right eye

OCULUS SINISTER (OS) - left eye

OCULUS UTERQUE (OU) - both eyes

OPHTHALMIC - pertaining to the eye or related functions

OPHTHALMOLOGIST - treats eye diseases and performs surgery. Has an MD and has taken a residency in Ophthalmology

OPHTHALMOLOGY - treatment of the pathological or unhealthy eye

OPTIC CHIASM - structure of nervous tissue formed by the junction and semi-decussation of the optic nerves in the region above the pituitary body

OPTIC DISK - that portion of the optic nerve which is formed by the meeting of all the retinal nerve fibers. It is insensitive to light and corresponds to the physiological blind spot.

OPTIC FORAMEN - hole located at the apex of the orbit through which the optic nerve passes

OPTIC NERVE - collection of over 800,000 fibers from the ganglion cells in the retina. It conducts nerve impulses to the optic tract

OPTIC RADIATIONS - nerve fibers transmitting impulses from the lateral geniculate body to the visual cortex in the occipital portion of the brain

OPTIC TRACTS - bundles of nerve fibers transmitting impulses from the optic chiasm to the lateral geniculate body

OPTICAL CENTRE - that point on a lens where light passes through without deviation

OPTICAL CROSS - method of describing the transportation between plus and minus cylinder

OPTICIAN - one who dispenses glasses or contact lenses

OPTOMETRIST - has at least six years of college, is concerned with vision and nonmedical visual care. Diagnoses and refers eye diseases. Uses lenses and prisms to correct refractive visual defects

ORA SERRATA - line formed by the anterior edge of the retina

OPACITY - loss of transparency

ORBICULARIS OCULI - an oval sheet of muscle that surrounds the palpebral fissure

ORTHOPHORIA - condition of the eyes in which the lines of sight, in the absence of an adequate fusion stimulis, intersect at a point of reference, this point usually being the point of binocular fixation

PALATINE BONE - small bone that helps form the posterior floor of the orbit

PALPEBRAL CONJUNCTIVA - conjunctiva covering the posterior surface of the eyelids

PANTOSCOPIC - tilt of the frame front of less that 90 degrees with respect to the temples

PARESIS - incomplete or partial loss or impairment of a muscle function

PATHOLOGY - study of the nature of diesases or any abnormal variation from a sound or healthy condition

PERIOSTEUM - specialized connective tissue that covers all the bones of the body

PHORIA - see heterophoria

PHOTOPIC - pertaining to the light levels of cone vision

PHYSIOLOGICAL SCOTOMA - a negative scotoma corresponding to the optic disc

PLANO - surface with zero curvature

PLICA SEMILUNARIS - crescent shaped fold of conjunctiva located at the medial canthus

PLUS LENS - lens that converges light to a real focus

POSITIVE SCOTOMA - area of the visual field where the patient does not see anything. Patient is aware of the loss

POSTERIOR CHAMBER - chamber of the eye bound anteriorly by the iris and posteriorly by the anterior surface of the crystalline lens.

PRESEYOPIA - condition wherein the accommodative power decreases with advancing age

PRIMARY ACTION - the major action of a muscle

PRISM - wedge-shaped piece of glass or transparent material having plane or curved sides

PRISM DIOPTER - one prism diopter produces a deviation of 1cm at a distance of 1 meter

PROGNOSIS - forcast or prediction of the course of a disease or injury

PTOSIS - falling down or drooping of the upper eyelid below its normal position

PUNCTA - small openings located on the margin of each eyelid near the medial canthus, through which tears drain

PUPIL - opening in the center of the iris

PUPILLARY REFLEX - constriction/dilation of the pupil on exposure to light stimulus

RADIUS OF CURVATURE - the distance from the center of curvature to the surface

REAL IMAGE - an image that actually exists and can be projected on a screen or plate

RECTI - straight

REFLECTED RAY - ray of light that leaves the surface of a mirror

REFLECTION - throwing back of light incident upon a surface

REFRACTED RAY - light ray that has had its course of travel bent or changed as it passes through a lens or other medium

REFRACTION - change in direction of light as it passes obliquely from one medium to another of a different density

REFRACTIVE ERROR - condition where parallel light rays entering the eye do not focus on the retina

RETINA - light receptive and innermost tunic of the eye (nervous tunic); represents the terminal expansion of the optic nerve

RETROSCOPIC - tilt of the frame front with respect to the temples to an angle greater than 90 degrees

RHODOPSIN - protein pigment contained in the rods of the retina necessary for vision in dim light

RODS - specialized cells in the retina responsible for discrimination of motion and night vision

SCLERA - white, opaque fibrous tunic of the eyeball

SCOTOMA - area absent of vision or depressed sensitivity. On the retina, positive. Behind the retina, negative.

SEBACEOUS - glands that secrete sebum or oil

SECONDARY ACTION - next major muscle action to the primary

SEMI-DECUSSATION - "splitting in half." One-half of the nerve fibers from one eye go to the opposite side of the brain

SENSORY - reception and transmission of an impulse, received from a stimulus to the CNS

SINGLE VISION - lens with one focus

SNELLEN - type of letter used to determine visual acuity

SPHENOID BONE - bone that helps form the posterior part of the medial wall, lateral wall and roof of the orbit

SPHERE - lens with one point focus

SPHERICAL EQUIVALENT - lens whose focal point coincides with the circle of least confusion of a given spherocylindrical lens

SPHEROCYLINDER - lens integrating a sphere and a cylinder

STEREOPSIS - binocular visual perception of three-dimensional space based on retinal disparity

STRABISMUS - condition in which binocular fixation is not present under normal conditions

STROMA (SUBSTANTIA PROPRIA) - thickest layer of the cornea located between Bowman's membrane and Descemet's membrane

STURMS CONOID - circle of least confusion

SUPERIOR - located above or directed upward in relation to the eye

SUPERIOR OBLIQUE MUSCLE - extraocular muscle that originates above and nasal to the optic foramen, passes through the trochlear pulley and inserts on the superior, temporal posterior portion of the sclera

SUPERIOR RECTUS MUSCLE - extraocular muscle that originates at the annulus of Zinn and inserts on the superior portion of the sclera

SUPPRESSION - process of ignoring what one sees

SUSPENSORY LIGAMENTS - threadlike structures which support the crystalline lens. Also called the Zonnules of Zinn

SYNAPSE - point of contact between adjacent neurons; point of transmitting an impulse from one to another

SYNERGISTS - muscles in one eye that together perform given ocular movement

TARSAL PLATE - thin plate of fibrous tissue located in the upper and lower eyelids

TEMPORAL - towards the temple

TONOMETER - instrument for measuring intraocular pressure

TONOMETRY - measurement of ocular tension for the purpose of detecting glaucoma

TORIC - compound or spherocylinder lens; lens containing two different curves on one surface

TRABECULAR MESHWORK - fine net of fibrillar tissue located at the angle of the anterior chamber of the eye

TRANSPARENT - pertains to a medium having the property of transmitting light so that objects can be seen through it

TRANSPOSITION - mathematical switching of one cylinder form to another

TRAUMA - any injury, wound, or shock

TRICHROMATIC - requiring the use of three color mixture primaries to match all color. Considered normal color vision.

TRIFOCAL - lens with three segments giving three ranges of vision

TROCHLEAR NERVE - fourth cranial nerve innervating the superior oblique muscle

TROCHLEAR PULLEY - ringlike structure of fibrocartilage attached to the nasal portion of the frontal bone. The superior oblique passes through the pulley, which changes the direction of pull of the muscle

TROPIA - see heterotropia

UVEAL - the iris, ciliary body and choroid, together forming the pigmented vascular layer of the eye. Conditions pertaining to these structures.

VASCULAR TUNIC - middle coat (tunic) of the eyeball that contains the choroid, iris, ciliary body and provides the blood supply to the eye

VELOCITY - speed of light which is dependent on the medium it is passing through

VERGENCE - disjunctive movement of the eyes, as in convergence or divergence.

VERSION - both eyes moving together in the same direction

VIRTUAL IMAGE - an image that has no real existence and cannot be projected on a screen

VISUAL ACUITY - acuteness, distinctness, clearness, or sharpness of vision

VISUAL CORTEX - that part of the brain that interprets the nerve impulses of the visual pathway

VISUAL FIELD - area or extent of physical space visible to an eye in a given position

VITREOUS HUMOR - gelatinous, colorless, transparent substance filling the vitreous chamber of the eye

WAVELENGTH - distance between the crest of one wave and the crest of the next wave

YOKED MUSCLES - muscles performing the same action in different eyes

ZONULES OF ZINN - suspensory fibers that connect the crystalline lens to the ciliary body

ZYGOMATIC BONE - bone that helps form the lateral wall and floor of the orbit

ABBREVIATIONS

ADD - bifocal add power

A/C - aircrew frame

BC - base curve

BIF - bifocal

BVA - best visual acuity

$\bar{C}$ - with

CT - cover test

$\overline{CC}$ - with correction

DVA - distant visual acuity

DBL - distance between lenses (bridge size)

DBMS - director of base medical services (hospital commander)

DPA-V - depth perception apparatus-Verhoeff

Dec - decentration

FPD - frame PD

FV - finger vision

IOP - intraocular pressure

LP - light perception

MgFl - magnesium fluoride(coated lenses)

NIBH - not indicated by history

NVA - near visual acuity

OD - right eye

OS - left eye

OU - both eyes

PERRLA - pupils equally round and react to light and accommodation

PPD - patients PD

PD - pupillary/interpupillary distance

Rx - treatment/prescription

Seg Ht - segment height

S-10 - standard male frame

S-14 - standard female frame

SSBV - single simultaneous binocular vision (fusion)

$\bar{S}$ - without

$\overline{SC}$ - without correction

TRI - trifocal

VTA-ND - vision test apparatus, near and distant

ZYL - "zylonite," plastic frame

ROOTS

Anterior - in front of

autonomic - self governing

aqua - water

ab - away from

ad - toward

a,an - not

anti - against

bi - two

bleph - eyelid

cilium - eyelash

canthos - corner

centr - center

chorion - leather

contra - against

chi - in the shape of the Greek letter
Chi (X)

chroma - color

centi - 100

di, diplo - two , double

dexter - right

distal - away from

endo - inside

epi - on, outer

es - into

ethmos - sieve, sponge

ex - out from

extra - outside

fornix - arch

fossa - pit, ditch

fovea - pit

frontal - forehead

fundus - bottom, deepest

globus - ball

hemi - half

heteros - different

hypo - under, down

homalos - normal

homo - same

homoeo - similar

inferior - lower

itis - inflammation

junct - join

lacrima - tears

leva(tor) - lifts, lifter

lateral - to the side, away from the midline

medial - toward the midline

maxilla - jaw (usually upper)

medius - middle

milli - 1000

oid - resemblance to

obicularis - surrounding

op - see

orbita - eye socket

oculus, ophthalmos - eye

posterior - in back of, toward the rear

proximal - nearest

palpebra - eyelid

pto - fall

pseudes - false

palpit - flutter

superior - above, over, higher

sinister - left

sphen - wedge

semi - half

sphincter - squeezes

simpathetic - feeling together

scleros - hard

script - write

super - over

sub - under

supra - over

tempora - temple

tri - three

zygoma - arch

STUDY GUIDE AND WORKBOOK

J3ABR91235 000-II

Technical Training

Optometry Specialist

BLOCK II

VISUAL ACUITY AND ITS CORRECTION

February 1984

SCHOOL OF HEALTH CARE SCIENCES, USAF
Department of Biomedical Sciences
Sheppard Air Force Base, Texas 76311

Designed for ATC Course Use RGL: 10.7

DO NOT USE ON THE JOB

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Department of Biomedical Sciences
School of Health Care Sciences, USAF
Sheppard Air Force Base, Texas 76311

SW J3ABR91235-000-II-1
February 1984

MILITARY SPECTACLE PROCUREMENT AND VERIFICATION

This Study Guide and Workbook (SW) is designed to give you information on taking the necessary measurements to select, order, dispense, verify, adjust and repair military spectacles as well as information on the styles and types of spectacles available in the military.

OBJECTIVES

1a. Given an instructor selected patient and WS J3ABR91235-000-II-1a, perform frame selection with no more than two (2) instructor assists.

b. Given WS J3ABR91235-000-II-1b, identify facts concerning lenses procured from military laboratories with 70% accuracy.

c. Given AFR 167-3 and necessary materials, complete spectacle order forms, seventeen (17) of twenty (20) must be correct.

d. Given ANSI Z80.1 Standards, and twelve (12) pairs of spectacles with their corresponding DD Forms 771s, verify that the spectacles meet the standards with no more than two (2) instructor assists per box.

e. Given an instructor selected patient, two (2) cellulose acetate frames, one (1) aircrew frame, and the necessary materials, adjust each frame to fit the patient with no more than one (1) instructor assist per frame.

f. Given an aircrew frame, an S-10 frame and the necessary materials, perform minor repair functions with no more than one (1) instructor assist per frame.

g. Given the necessary materials, duplicate eighteen (18) pairs of spectacles with at least fifteen (15) within ANSI standards.

INTRODUCTION

The duties most often performed by an optometry specialist include the ordering, verification, dispensing, and repair of eyewear. This unit of instruction will present the information needed to perform these important tasks.

MILITARY SPECTACLE FRAMES

Types and Styles

1. Plastic Frames

In the field, all plastic frames are frequently referred to as a "Zyl" frame. The term "Zyl" is an abbreviation for "Zylonite" which was a trade name for the earliest cellulose nitrate frames. Although plastic frames are now made of different material, the term has survived for many years.

All standard issue military plastic frames are manufactured of thermoplastic cellulose acetate. The color is black. Cellulose acetate is used in the frames rather than the older compound, cellulose nitrate, because the nitrate material ignites easily and burns rapidly. Cellulose acetate will burn too, but it takes a higher temperature to ignite it, and it burns rather slowly. Cellulose acetate frames soften readily in the frame warmer, making them easy to adjust.

There are two standard issue plastic frames in the Air Force.

a. The standard issue plastic frame for male personnel is the S-10. The term "S-10" means that there is a 10 mm difference between the horizontal and vertical measurements of each lens, i.e., if the eye size is 48 mm (the horizontal dimension is 48 mm), the vertical dimension would be 38 mm (48 - 10 = 38 mm).

This supersedes SW J3ABR91235-000-II-1, January 1983. Previous editions may not be used.

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b. The standard issue plastic frame for female personnel is the S-14, with a 14 mm difference between the horizontal and vertical lens dimensions.

c. Another plastic frame, which may be issued under special conditions, is the half-eye frame. Issue of this frame is restricted to military personnel who hold an administrative position. The half-eye frame is designed for presbyopes who need no distance correction. Astigmatic correction may not exceed -0.75D. When the frame is prescribed, the optical lab will determine size based on patient P.D. and decentration requirements. No male or female specifications are used in connection with this frame.

The S-10 male and S-14 female frames comes in a range of sizes suitable for most patient needs. Figures 1-1 and 1-2 indicate stock numbers and sizes available in each style.

2. The Aircrew Spectacle Frame

AFR 167-3 lists personnel eligible for issue of the aircrew spectacle frame. The frame was designed for personnel on flying status. It is metal with 5½ inch plastic tipped bayonet temples or 6½ inch matte chrome comfort cables. The front is available in one size only, 52 eye size (52 mm x 42 mm) and 20 bridge size. No male or female specifications are used. Figure 1-3 illustrates the aircrew frame and related supply information.

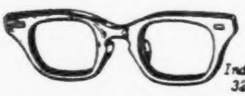
Frame Parts

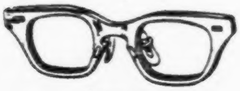
A spectacle frame consists of three basic parts: a front and two temples. The front consists of the eyewire, bridge bar, two fixed or adjustable nose pads, the end-pieces, hinges, hinge shield, and lens groove. Temple styles are of the skull or bent library type (standard issue on the male and female zyl frames), riding bow or comfort cable styles (also available as standard issue for the male or female frame), and the straight library temples (standard on the half-eye frame). Figure 1-4 illustrates the parts of a frame.

Temples are measured in inches; all other frame measurements are in millimeters. The eye size is the horizontal dimension of one lens (50 mm, 48 mm, 46 mm, etc.). The bridge size or DBL is the distance between lenses (26 mm, 24 mm, 22mm, etc.). Frame size specifications are written in the following manner: 46-22-4 1/2, which means a 46 mm eye size combined with a 22 mm bridge and 4 1/2 inch temples. You should remember that "Frame P.D." is equal to the sum of the eye size and bridge size. For example, the frame P.D. (FPD) of a 46-22 frame is 68 mm. All of your decentration computations are based on the relative values of the FPD and the patient's P.D. Temple lengths for the skull (or spatula) temples are measured from the butt to the bend; temple lengths for the comfort cable temples are specified from the butt to the tip (Figure 1-4). Size of the frame parts (front and temples) are stamped on the inner side of the respective part.

The bridge style of the S-10 and S-14 are of the keyhole type. A keyhole bridge resembles a large old-fashioned keyhole. When the standard keyhole bridge does not mate well with the patient's nose, these frames may be ordered with adjustable nose pads. (See Figure 1-1). When ordering a plastic frame with adjustable pads, it is usually necessary to order the bridge size larger than the corresponding keyhole bridge size. This allows additional room for the guard arms and for making appropriate adjustments. The metal aircrew frame is available only with adjustable nose pads and only in one size, 20 mm. The half-eye frame has a saddle bridge. A saddle bridge places more frame area on the surface of the nose and is "all-fitting," a desirable characteristic because of the various positions on the nose that the half-eye is worn.

FRONT, SPECTACLE


Index No.
325-400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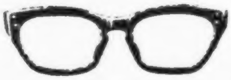
405-475

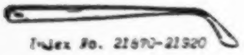

Index No.
485-540

Action	Index No.	National Stock No.	Descriptive Data
	S-10 EYESHAPE		
—	325	6540-00-482-4292	Cellulose Acetate, Black, 44 Eye, 20 Bridge
—	330	6540-00-482-4293	Cellulose Acetate, Black, 44 Eye, 22 Bridge
—	335	6540-00-482-4294	Cellulose Acetate, Black, 44 Eye, 24 Bridge
—	340	6540-00-482-4295	Cellulose Acetate, Black, 44 Eye, 26 Bridge
—	345	6540-00-482-9387	Cellulose Acetate, Black, 46 Eye, 20 Bridge
—	350	6540-00-482-9388	Cellulose Acetate, Black, 46 Eye, 22 Bridge
—	355	6540-00-482-9389	Cellulose Acetate, Black, 46 Eye, 24 Bridge
—	360	6540-00-482-9390	Cellulose Acetate, Black, 46 Eye, 26 Bridge
—	365	6540-00-482-9391	Cellulose Acetate, Black, 48 Eye, 20 Bridge
—	370	6540-00-482-9392	Cellulose Acetate, Black, 48 Eye, 22 Bridge
—	375	6540-00-482-9393	Cellulose Acetate, Black, 48 Eye, 24 Bridge
—	380	6540-00-482-9394	Cellulose Acetate, Black, 48 Eye, 26 Bridge
—	385	6540-00-482-9395	Cellulose Acetate, Black, 50 Eye, 20 Bridge
—	390	6540-00-482-9396	Cellulose Acetate, Black, 50 Eye, 22 Bridge
—	395	6540-00-482-9397	Cellulose Acetate, Black, 50 Eye, 24 Bridge
—	400	6540-00-482-9398	Cellulose Acetate, Black, 50 Eye, 26 Bridge
—	405	6540-00-497-2454	Cellulose Acetate, Black, Adjustable Rocking Nose Pads, 44 Eye, 22 Bridge
—	410	6540-00-497-2455	Cellulose Acetate, Black, Adjustable Rocking Nose Pads, 44 Eye, 24 Bridge
—	415	6540-00-497-2456	Cellulose Acetate, Black, Adjustable Rocking Nose Pads, 44 Eye, 26 Bridge
—	420	6540-00-497-2457	Cellulose Acetate, Black, Adjustable Rocking Nose Pads, 46 Eye, 20 Bridge
—	425	6540-00-497-2458	Cellulose Acetate, Black, Adjustable Rocking Nose Pads, 46 Eye, 22 Bridge
—	430	6540-00-497-2459	Cellulose Acetate, Black, Adjustable Rocking Nose Pads, 46 Eye, 24 Bridge
—	435	6540-00-497-2460	Cellulose Acetate, Black, Adjustable Rocking Nose Pads, 46 Eye, 26 Bridge
—	440	6540-00-497-2461	Cellulose Acetate, Black, Adjustable Rocking Nose Pads, 48 Eye, 20 Bridge
—	445	6540-00-497-2462	Cellulose Acetate, Black, Adjustable Rocking Nose Pads, 48 Eye, 22 Bridge
—	450	6540-00-497-2463	Cellulose Acetate, Black, Adjustable Rocking Nose Pads, 48 Eye, 24 Bridge
—	455	6540-00-497-2464	Cellulose Acetate, Black, Adjustable Rocking Nose Pads, 48 Eye, 26 Bridge
—	460	6540-00-497-2465	Cellulose Acetate, Black, Adjustable Rocking Nose Pads, 50 Eye, 20 Bridge
—	465	6540-00-497-2466	Cellulose Acetate, Black, Adjustable Rocking Nose Pads, 50 Eye, 22 Bridge
—	470	6540-00-497-2467	Cellulose Acetate, Black, Adjustable Rocking Nose Pads, 50 Eye, 24 Bridge
—	475	6540-00-497-2468	Cellulose Acetate, Black, Adjustable Rocking Nose Pads, 50 Eye, 26 Bridge
	FEMALE STYLE		
—	485	6540-00-042-8540	Female Style, Cellulose Acetate, Black, 44 Eye, 18 Bridge
—	490	6540-00-042-8541	Female Style, Cellulose Acetate, Black, 44 Eye, 20 Bridge
—	495	6540-00-042-8542	Female Style, Cellulose Acetate, Black, 44 Eye, 22 Bridge
—	500	6540-00-042-8545	Female Style, Cellulose Acetate, Black, 44 Eye, 24 Bridge
—	505	6540-00-042-8549	Female Style, Cellulose Acetate, Black, 46 Eye, 18 Bridge
—	510	6540-00-042-8563	Female Style, Cellulose Acetate, Black, 46 Eye, 20 Bridge
—	515	6540-00-042-8591	Female Style, Cellulose Acetate, Black, 46 Eye, 22 Bridge
—	520	6540-00-042-8606	Female Style, Cellulose Acetate, Black, 46 Eye, 24 Bridge
—	525	6540-00-042-8634	Female Style, Cellulose Acetate, Black, 48 Eye, 18 Bridge
—	530	6540-00-042-8648	Female Style, Cellulose Acetate, Black, 48 Eye, 20 Bridge
—	535	6540-00-042-8668	Female Style, Cellulose Acetate, Black, 48 Eye, 22 Bridge
—	540	6540-00-042-8669	Female Style, Cellulose Acetate, Black, 48 Eye, 24 Bridge

Figure 1-1

TEMPLE, SPECTACLE

Consists of one left and one right temple.



Index No. 21870-21920

METAL

Suitable for use with spectacle frame, Index No. 190.

Action	Index No.	National Stock No.	Descriptive Data	Notes
	COMFORT CABLE TYPE			
—	21870	6540-00-926-9013	Gold-Plated, Comfort Cable Type, 6-1/2 inch	N

PLASTIC

Fits standard black plastic S-10 fronts.

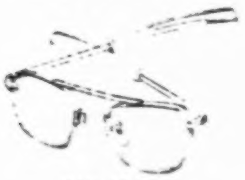
Action	Index No.	National Stock No.	Descriptive Data
	PADDLE TYPE		
—	21880	6540-00-181-8086	Cellulose Acetate, Paddle Type, Black, 4 inch
—	21885	6540-00-482-4296	Cellulose Acetate, Paddle Type, Black, 4-1/4 inch
—	21890	6540-00-482-4297	Cellulose Acetate, Paddle Type, Black, 4-1/2 inch
—	21895	6540-00-482-4298	Cellulose Acetate, Paddle Type, Black, 4-3/4 inch
—	21900	6540-00-482-4299	Cellulose Acetate, Paddle Type, Black, 5 inch
	RIDING BOW CABLE TYPE		
—	21910	6540-00-478-6594	Cellulose Acetate, Riding Bow Cable Type, Black, 6-1/4 inch
—	21915	6540-00-478-6595	Cellulose Acetate, Riding Bow Cable Type, Black, 6-1/2 inch
—	21920	6540-00-181-8316	Cellulose Acetate, Riding Bow Cable Type, Black, 6-3/4 inch

PLASTIC. Index No. 235-245—Consists of 6 in. (15.24 mm) library-type temples; screw, 5305-00-926-5590; and standard half-eye front.
Index No. 250-315—Assembled from temple, Index No. 21880, screw, 5305-00-926-5590; and proper size front, Index No. 325-350, 390, and 395.

—	235	6540-01-099-4067	Cellulose Acetate, Black, Half-Eye, Library Temples, 44 mm Eye, 24 mm Bridge	—
—	240	6540-01-099-4068	Cellulose Acetate, Black, Half-Eye, Library Temples, 46 mm Eye, 24 mm Bridge	—
—	245	6540-01-099-4069	Cellulose Acetate, Black, Half-Eye, Library Temples, 48 mm Eye, 24 mm Bridge	—
—	250	6540-00-689-3674	Cellulose Acetate, Black, Paddle Temples, 44 Eye, 20 Bridge	—
—	255	6540-00-689-3675	Cellulose Acetate, Black, Paddle Temples, 44 Eye, 22 Bridge	—
—	260	6540-00-689-3676	Cellulose Acetate, Black, Paddle Temples, 44 Eye, 24 Bridge	—
—	265	6540-00-689-3682	Cellulose Acetate, Black, Paddle Temples, 44 Eye, 26 Bridge	—
—	270	6540-00-689-3680	Cellulose Acetate, Black, Paddle Temples, 46 Eye, 20 Bridge	—
—	275	6540-00-495-7145	Cellulose Acetate, Black, Paddle Temples, 46 Eye, 22 Bridge	—
—	280	6540-00-495-7146	Cellulose Acetate, Black, Paddle Temples, 46 Eye, 24 Bridge	—
—	285	6540-00-689-3683	Cellulose Acetate, Black, Paddle Temples, 46 Eye, 26 Bridge	—
—	290	6540-00-689-3684	Cellulose Acetate, Black, Paddle Temples, 48 Eye, 20 Bridge	—
—	295	6540-00-495-7147	Cellulose Acetate, Black, Paddle Temples, 48 Eye, 22 Bridge	—
—	300	6540-00-181-8330	Cellulose Acetate, Black, Paddle Temples, 48 Eye, 24 Bridge	—
—	305	6540-00-181-8382	Cellulose Acetate, Black, Paddle Temples, 48 Eye, 26 Bridge	—
—	310	6540-00-689-3685	Cellulose Acetate, Black, Paddle Temples, 50 Eye, 22 Bridge	—
—	315	6540-00-689-3686	Cellulose Acetate, Black, Paddle Temples, 50 Eye, 24 Bridge	—

Figure 1-2

FRAME, SPECTACLE



Action	Index No.	National Stock No.	Descriptive Data	Notes
			METAL. Plated. Double bar; special eyewire shape front. Index No. [illegible] and [illegible]—Plastic tip temple. Index No. [illegible]—Matte chrome plated. Plastic covered 6-1/2 in. (16.5 cm) temples. Index No. [illegible]—Suitable for use with spectacle temple, Index No. [illegible].	
—	[illegible]	6540-01-099-2321	Bayonet Temples. 42 by 52 Eye. 20 Bridge	—
—	[illegible]	6540-01-096-4496	Comfort Cable Temples. 42 by 52 Eye. 20 Bridge	—
—	[illegible]	6540-00-782-6502	Gold Plated. Bayonet Temples. 42 by 52 Eye. 20 Bridge	M

Figure 1-3

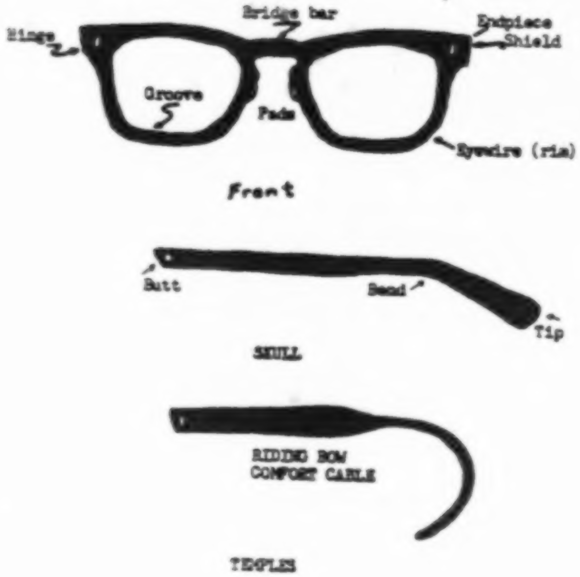
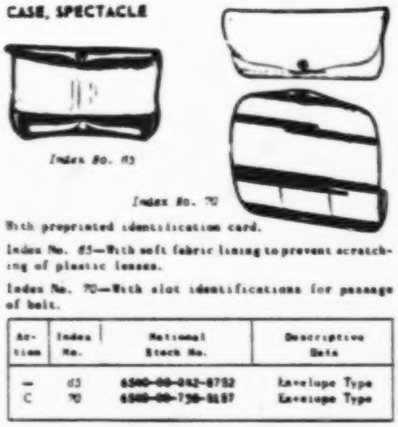

Bridge bar
Hinge
Endpiece
Shield
Groove
Pads
Eyewire (rim)
Front
Butt
Bend
Tip
SKULL
RIDING BOW
COMFORT CABLE
TEMPLES

Figure 1-4

Spectacle Cases

It is necessary to keep replacement spectacle cases on hand in the eye clinic. Two types of cases are available through normal supply channels. This information is provided for you in Figure 1-5. Note that the spectacle case for plastic lenses is different than the one for glass lenses.



CASE, SPECTACLE

Index No. 63

Index No. 70

With preprinted identification card.

Index No. 63—With soft fabric lining to prevent scratching of plastic lenses.

Index No. 70—With slot identifications for passage of belt.

Action	Index No.	National Stock No.	Descriptive Data
—	63	6540-00-042-8752	Envelope Type
C	70	6540-00-738-8187	Envelope Type

Figure 1-5

Gas Mask Frames

There are several gas mask inserts available to Air Force personnel, but we'll cover only the two most common.

The M-17 comes in one size only. It is considered dual fit because it fits inside both the M-17 and the M-17A1 gas masks. The M-17 is metal with a frame PD of 70 mm. The lens is an S-10 shape, 44 mm eye size. (See Figure 1-6).

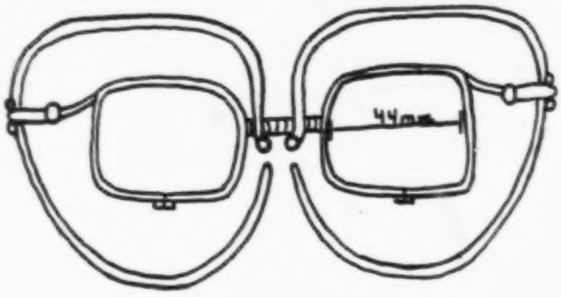


Figure 1-6

Looking at Figure 1-6, note the hooping wires around the lenses. These wires fit into a rubber groove around the eye pieces and keep the insert in the mask.

The M-17A1 gas mask insert is different. It's plastic and fits not only the M-17A1 mask, but also the M-14A2 and M-25. The eye size is 38 mm and the frame PD is 66 mm. (See Figure 1-7).

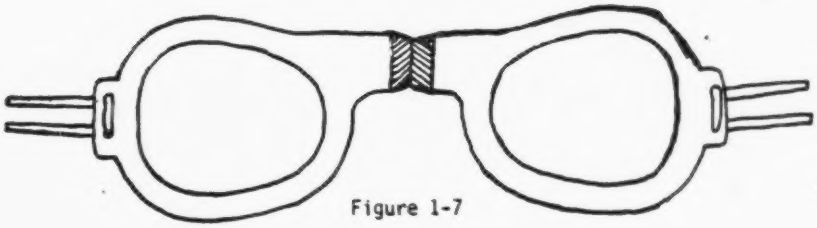


Figure 1-7

The M-17A1 gas mask has some holes on either side of the eye pieces. The metal prongs extending out from the insert fit into the holes. The insert can be placed high, low, or in the middle depending on the patient's preference. The M-17A1 is known as the "universal" gas mask insert.

EXERCISE II-1a

INSTRUCTIONS

Fill in the blanks.

1. Today's military S-10 and S-14 frames are manufactured with a material called ________________ ________________ because it is difficult to ignite and burns slowly.
2. What bridge sizes are available in the S-10 frame? ________________
3. What eye sizes are available in the S-14 frame? ________________
4. Comfort cable temples are measured from ________________ to ________________.
5. The S-10 and S-14 frames have a ________________ type bridge and the half-eye frame has a ________ type bridge.
6. The S-10 and S-14 frames can be ordered with either ____________ or ____________ ____________ type temples.

What are the horizontal and vertical dimensions of lenses mounted to fit the following military spectacle frames?

7. S-10, MALE, 46 EYE ________________
8. S-10, MALE, 50 EYE ________________
9. S-14, FEMALE, 44 EYE ________________
10. S-14, FEMALE, 46 EYE ________________
11. Aircrew frame, 52 EYE ________________
12. What is the frame PD of an S-10 - 50 - 22 frame? ________________
13. What type nose pads come standard on the aircrew frames? ________________
14. What types of gas mask inserts do we commonly order? ________________ and ________________
15. Which gas mask insert fits both the M-17 and M-17A1? ________________
16. Which gas mask insert fits the M 14A-2 and M-25 type gas masks? ________________
17. Name the two gas mask inserts and the FPD for both. ________________
18. There is a difference of ____________ inches between the temple bend and the tip of the skull temple.
19. The temple used on the standard military half-eye frame is called the ____________ temple.

INTERPUPILLARY DISTANCE MEASUREMENT

The interpupillary distance or "P.D." is the distance between the centers of each pupil measured in millimeters. The PD measurement is needed to properly center the spectacles and avoid unwanted prismatic effect. Measuring a patient's PD is accomplished with a PD rule (Rule, measuring, opthalmological, NSN 6515-00-362-6200).

Significance of the PD Measurement

It's essential to measure the PD accurately, expecially in high prescriptions. For example, if the technician mismeasures the PD of a patient by 2 mm, decentration of the lenses will be 2mm in error. In this case, if the patient's Rx is O.U. -5.00 D., the error will create 0.50 prism diopters of horizontal prism before each eye, or a total prismatic effect of 1.00 prism diopter. This would likely create patient distress and an inability to wear the spectacles, even though every thing else pertaining to the spectacles is correct. The key point is that you, as the technician, must measure each PD with extreme care. An accuracy of ±0.5 mm is desirable.

Measurement of the PD

Seat the patient facing the examiner at eye level. Place the millimeter ruler on the bridge of the patient's nose. Hold the ruler with the thumb and first finger and stabilize the ruler by placing the last three fingers against the patient's temple area. Instruct the patient to look at your left eye (Figure 1-8).

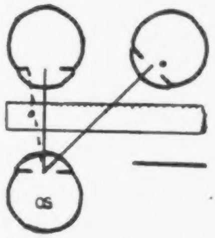


Figure 1-8

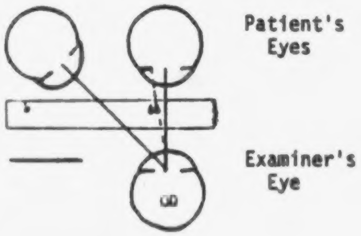


Figure 1-9

Close your right eye. Line up the zero mark on the PD ruler with the temporal limbus of the patient's right eye. Have the patient look at your open left eye. Now look at the patient's nasal limbus of his left eye and note the reading. Record this as the near PD. Now open your right eye, without moving the ruler and close your left eye. Instruct the patient to look at your right eye. Record this finding as far PD (Figure 1-9). Place your findings on the patient's record form in millimeters, e.g., 66/63 mm. The far PD is used to determine the placement (decentration) of the optical centers in spectacles worn for distance purposes. The near PD is for decentration of the bifocal portion or for the decentration of the optical centers of spectacles worn for reading. Because the eyes converge at the near point, the near PD will measure 2 to 4 mm less than the far PD.

Your first few measurements for PD may be off several millimeters, but as you practice your technique on the other students, you will find that your results will improve.

Remember, that it is more accurate to measure from the temporal limbus of the O.D. to the nasal limbus of the O.S., rather than from pupil center to pupil center. This is because it is difficult to estimate precisely the location of the pupil centers, while the corneal-scleral junction (limbus) is a very apparent landmark.

PD Measurements in Strabismus

If the patient has strabismus or the inability to use both eyes together, you must take an additional step. It's necessary that the patient fixate each of your eyes during the measurement. To accomplish this, cover the non-fixating eye with an occluder and measure as before.

PD and Decentration

For the lenses to be most effective, the patient's line of sight must coincide with the optical centers. This is accomplished by decentration, which eliminates unwanted prismatic effect. Decentration is the difference between the patient's PD (PPD) and the frame PD (FPD).

For example, if a patient needs a 48-22 front and the PPD is 66/63, you find the FPD: (eyesize + bridgesize = FPD) 48 + 22 = 70 mm, then subtract the PPD to find total decentration needed: 70-66 = 4mm, then divide by 2 to find decentration needed for each eye: 4 ÷ 2 = 2mm IN (decentration is always IN if the FPD is greater than the PPD). A fuller discussion of decentration will be found later in this unit.

EXERCISE II-1b

INSTRUCTIONS

Complete the following statements in the spaces provided.

1. The interpupillary distance, or "PD", is the distance between the centers of each pupil measured in millimeters. This measurement is equal to the distance between the ______________________ ______________________ of the right eye and the ______________________ ______________________ of the left eye.
2. When measuring the far PD, align the zero mark of the millimeter rule with the ______________ ______________________ limbus of the patient's right eye with your ______________ eye and read the ruler at the ______________ limbus of the patient's left eye using your ______________________ eye.
3. A PD is measured and recorded as 66/63 mm. The number ______________ is the far PD and ______________________ is the near PD.
4. If the patient has strabismus, you should ______________________ the patient's left eye when aligning the zero mark and then ______________________ the patient's ______________________ when taking the measurement reading.
5. If the frame PD is smaller than the patient's PD the lenses must be decentrated ______________ for proper alignment.
6. When measuring PD you always hold the 0 mark on the ruler to your ______________________.
7. What adverse effects could result from a poorly measured PD? ______________________

FRAME SIZE SELECTION

The steps in frame size selection generally follow this order:

1. The first measurement is the PD (as described previously).

2. Bridge (DBL) is then determined. This is most easily accomplished with the aid of a trial fitting set -- i.e., try different bridge sizes on the patient until a good, comfortable fit is found.

3. Eye size should be selected so that the overall width of the frame is approximately equal to the overall width of the patient's head. The temples should go straight back to just before the ears. However, sometimes a patient may have a very narrow or extremely wide PD and the above rule may have to be modified. Also, when determining eye size, remember that patients with extremely high Rxs may look better in a frame with an eye size slightly smaller than normal.

4. Temple length is usually determined by educated trial and error using a trial fitting set. The temple should fit as illustrated in Figure 1-10.

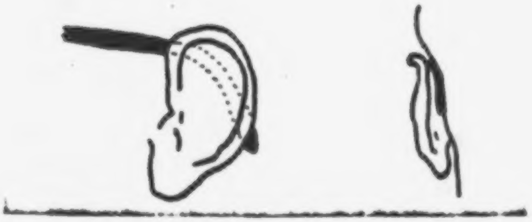


Figure 1-10

Bifocal and Trifocal Segment Heights

Since frame selection includes bifocal and trifocal segment (seg) heights, we will discuss these measurements next.

Most spectacle frames have grooves that the lenses fit into (see Figure 1-11). These grooves hold the lenses in place and are usually about 1 millimeter (mm) deep. Optical labs place the top of a multifocal segment some specified distance from the bottom of the finished lens. Since lenses sit in the bottom of the groove, you must include the groove depth in your multifocal measurements. If you don't, the segments will be set too low in the frame.

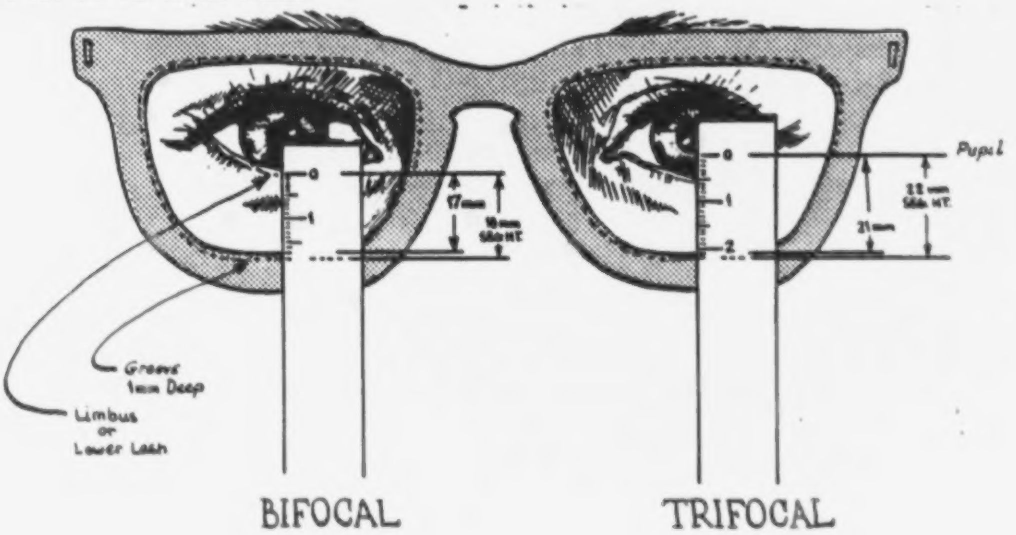


Figure 1-11

Now you are ready to measure bifocal and trifocal seg heights. Basic bifocal segs should be measured from the lower limbus to the bottom of the groove in the lower eye wire. (Refer to Figure 1-11) Sometimes, the patient's lower limbus is hidden behind the lower eye lid. If that's the case, measure from the lower lid margin.

Measure trifocal seg heights from the bottom of the pupil to the bottom eyewire groove. (See Figure 1-11). Since the pupils tend to dilate (get larger) in dim light and constrict (get smaller) in bright light, always measure trifocal segs in normal room lighting.

The steps for basic bifocal and trifocal seg measurements are generally as follows:

1. Put the frame on the patient.

2. Level the frame on the patient's face.

3. Check the pantoscopic tilt.

4. Align yourself and the patient so you are both at the same eye level, about 16 to 18 inches apart.

5. Be sure the patient's face is not tipped forward or backward; the face must be perpendicular to the floor.

6. Tell the patient to look straight into your eyes. Do not allow the patient to move his/her head.

7. Hold the PD rule with the 0 mark up.

8. Align the 0 mark on the lower limbus (or lower lid), note which mark on the PD rule intersects the top edge of the lower eyewire, and add 1 mm. That is the basic bifocal seg measurement.

9. Measure the basic trifocal seg height the same way you measured the bifocal EXCEPT, align the 0 mark on the bottom of the pupil rather than the lower limbus (or lid). When ordering trifocals you must specify total segment height, not bifocal height.

EXERCISE II-1c

INSTRUCTIONS

1. When measuring multifocal segment heights how much distance is allowed for the groove in the eye wire? ____________________

2. The basic bifocal height is measured from ______________ to ______________.

3. The basic trifocal height is measured from ______________ to ______________.

4. When ordering trifocals which segment height do you specify? ______________

II-1b. Given AFR 167-3 and the necessary materials, complete spectacle order forms, seventeen (17) of twenty (20) must be correct.

TYPES OF LENSES AVAILABLE IN MILITARY

Several types or styles of lenses are available from military optical labs; some of these lenses are "standard" while others must have a special justification. This unit of instruction will describe the common military lenses available.

Single Vision Lenses

Most military spectacles have single vision glass or plastic lenses. Glass lenses are specially treated to resist breakage, but all eyewear lenses will break if subjected to enough stress. All single vision lenses are ground in minus cylinder form.

Fig. 2-1 Single Vision

Multifocal Lenses

The standard bifocal lens available from military optical labs is the ST-25 bifocal (Figure 2-2). "ST" means "straight top" and "25" refers to the width of the bifocal segment in mm. This bifocal may also be called a "D-25" bifocal. The St-25 or D-25 bifocal in glass lenses is a "fused" bifocal; the bifocal segment is made of glass of a different index of refraction than the carrier lens, and is fused or melted onto the carrier. Plastic bifocals are usually "one piece" bifocals; the segment power is varied by changing the surface curve of the segment.

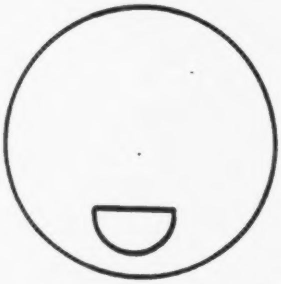


Fig. 2-2 ST-25 bif.

Another fused bifocal is the Kryptok, which use to be the standard type. The Kryptok bifocal (Figure 2-3) is a 22 mm round segment with higher color aberration than the D-25. The optics were also a little poorer in the Kryptok than in the D-25. These lenses are rarely used today but can be obtained by special order, if necessary.

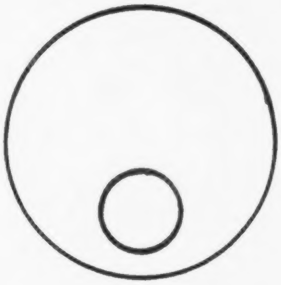


Fig. 2-3 Kryptok bif.

The "executive" or "Ben Franklin" bifocal (Figure 2-4) is a one piece bifocal with the segment occupying the entire width of the lens. This lens is manufactured from one piece of glass with two different spherical front curves, one for distance and one for reading. It's usually heavier because the lab has to start with a thicker carrier to grind the lower segment.

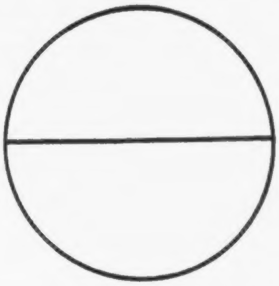


Fig. 2-4 Executive

All trifocals are special order lenses; they may be ordered as a ST-25 trifocal (Figure 2-5), or an executive trifocal, (Figure 2-6). The intermediate segment is usually 50 percent of the bifocal add power. The standard distance from the top of the bifocal to the top of the trifocal is 7 mm.

Another special-order lens is the Double D bifocal (Figure 2-7). Two bifocals are used on one carrier. Some pilots may use the top bifocal to see an overhead radio panel, while still seeing check lists and distance objects clearly. This can also be made as a double executive.

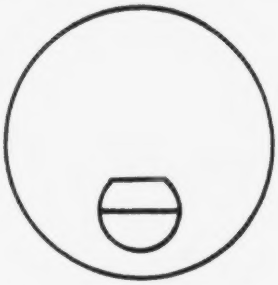


Fig. 2-5 7 x 25 trif.

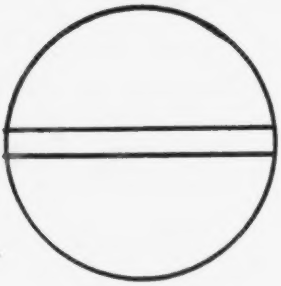


Fig. 2-6 Exec. trif.

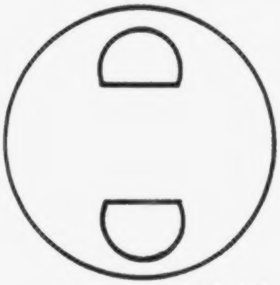


Fig. 2-7 "Double D"

Tinted and/or Coated Lenses

Two tint densities are available from military optical labs, N-15 (neutral density grey 15% transmittance) and N-31 (neutral density grey 31% transmittance). Other tints are available only with special justification. Not everybody can receive tinted lenses. AFR 167-3 contains pertinent data concerning tints and their availability.

An antireflective magnesium flouride coating (MgF1) may be plated onto the glass lens surface to reduce unwanted reflections. These lenses are prescribed in accordance with AFR 167-3. N-15 coatings are available for high-power lenses if needed. The chart below shows availability of tints and coatings for specific lens power ranges.

Power	Available Tint or Coating
$\substack{+1.50 \\ -2.75}$ or less in any meridian	N-15, through and through
More than $\substack{+1.50 \\ -2.75}$ in any meridian, but no greater than $\pm$ 5.50 in any meridian	N-15 coating (uniform density)
$\substack{+4.00 \\ -5.50}$ or less in any meridian	N-31, through and through
More than $\substack{+4.00 \\ -5.50}$ in any meridian, but no greater than $\pm$ 8.00 in any meridian.	N-31 coating (uniform density) In standard cellulose acetate frame.
Up to $\pm$ 5.50 in any meridian	Antireflective coating in Aircrew
Over $\pm$ 5.50 in any meridian	Antireflective coating in S-10 and S-14

Aircrew members may wear no tint, other than that prescribed, while performing flying duties.

Absorption by Tinted Lenses

When a substance will absorb some wavelengths, but not others, this is called SELECTIVE ABSORPTION. Pigments reflect their characteristic color but absorb most other wave-lengths. A red car, for example, reflects red and absorbs most other wavelengths. Filters selectively absorb light because they transmit their characteristic color and absorb all other wavelengths.

Sunglasses act as if they were filters. The N-15 sunglass tint appears grey in color, and reduces light intensity over the visible spectrum more or less uniformly. Approximately 15% of the visible light striking the N-15 lens is allowed to pass through; the 85% absorbed light is changed to heat or thermal energy. N-15 (and other good sunglass lenses) also effectively reduce transmitted infrared and ultraviolet.

N-31 lenses act in much the same way as N-15 lenses. The major difference is that N-31 lenses allow 31% of the incident visible light to pass through.

Softlight, Rose, Pink, and other light pink shades are used by some people to reduce the psychological problems of glare from fluorescent lights. They significantly reduce UV transmission.

Photochromic lenses change color when exposed to light, thus increasing their absorbancy characteristics. Photochromic lenses contain inorganic salts sensitive to ultraviolet light.

Polarizing lenses reduce glare by limiting the wave motion of the light to one plane. The last section described the principle of polarization.

Antireflective glasses are coated with a chemical called Magnesium Fluoride (MgFl). This coating is carefully deposited on the lens so it is only 1/4 wavelength thick. This thin coat of MgFl reduces reflections significantly, and allows more light to pass through the lens. MgFl coated glasses are often called "CCG" glasses in the military (CCG = clear coated glass).

Just as MgFl may be coated on a lens, so may other tints. Patients with high power prescriptions can enjoy the benefits of tinted lenses, without the cosmetic problems associated with through and through tinted high power lenses.

Impact Resistant Lenses

Since 1971, ophthalmic lenses must be impact resistant. Glass lenses may be made more resistant to breakage by heat treatment or by chemical treatment. Heat treated lenses show a strain pattern called a "maltese cross" on a colmascope. This pattern will not be seen when a lens has been chemically treated.

Plastic (CR-39) lenses are also available. The plastic lens is highly impact resistant but is also very susceptible to scratching. There is no strain pattern seen in plastic lenses.

Special Purpose Lenses

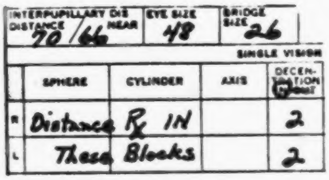
These are non standard lenses that require a reason or justification. The labs won't just arbitrarily fabricate anything you order. Some examples of special-purpose lenses are trifocals and double segment lenses. Others include tinted lenses (other than neutral gray), Magnesium Fluoride coated lenses (other than Aircrew orders), prism segment bifocals, lenticular lenses, myodisc lenses, special base curves for high Rxs and industrial thickness lenses. For more information consult AFR 167-3.

Decentration Entries

Decentration is equal to the distance between the optical center of a lens and its actual geometrical center. The reason for decentering a lens is to create or eliminate prism (prismatic effect).

To compute decentration we must have the following information: The patient's interpupillary distance (PD) and the frame PD (FPD). Then substract the smaller of the two measurements from the larger and divide by two (2) for each eye. Decentration is specified as IN if the frame PD is larger and OUT if it is smaller than the patient's PD.

The following examples will show you how we computed decentration for a distance Rx, a reading Rx, and near decentration for a bifocal.



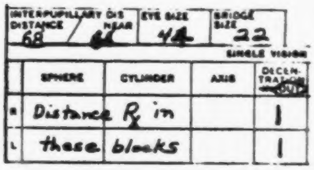
INTERPUPILLARY DIS DISTANCE 70 / NEAR 66 | EYE SIZE 48 | BRIDGE SIZE 26

SINGLE VISION

	SPHERE	CYLINDER	AXIS	DECENTRATION [✓ IN] OUT
R	Distance	Rx IN		2
L	These	Blocks		2

Figure 2-8

In this first example the distance PD (70 mm) was subtracted from the larger frame PD (74 mm). We had a remaining 4 mm total decentration which we divided by two (2) (2 eyes). This left us with 2 mm IN decentration for each eye. (Figure 2-8)



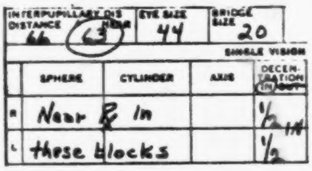
INTERPUPILLARY DIS DISTANCE 68 / NEAR 66 | EYE SIZE 44 | BRIDGE SIZE 22

SINGLE VISION

	SPHERE	CYLINDER	AXIS	DECENTRATION IN [✓ OUT]
R	Distance	Rx in		1
L	these	blocks		1

Figure 2-9

This time we have a distance PD of 68 mm. The frame PD is 66 mm. Note that the patient's PD is larger than the frame PD. If we subtract 66 from 68 mm and divide by two (2) (2 eyes), the decentration would be 1 mm OUT for each eye. (Figure 2-9)



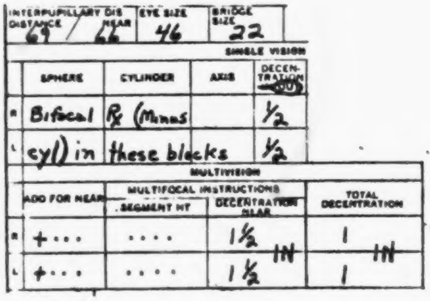
INTERPUPILLARY DIS DISTANCE 66 / NEAR 63 | EYE SIZE 44 | BRIDGE SIZE 20

SINGLE VISION

	SPHERE	CYLINDER	AXIS	DECENTRATION [✓ IN] OUT
R	Near	Rx In		½ IN
L	these	blocks		½

Figure 2-10

In the third example the form indicates a reading prescription. There is only one difference. We use the patient's NEAR PD. (Figure 2-10)



INTERPUPILLARY DIS DISTANCE 69 / NEAR 66 | EYE SIZE 46 | BRIDGE SIZE 22

SINGLE VISION

	SPHERE	CYLINDER	AXIS	DECENTRATION IN [✓ OUT]
R	Bifocal	Rx (Minus		½
L	cyl) in	these blocks		½

MULTIVISION

	ADD FOR NEAR	MULTIFOCAL INSTRUCTIONS SEGMENT HT	MULTIFOCAL INSTRUCTIONS DECENTRATION NEAR	TOTAL DECENTRATION
R	+···	····	1½ IN	1 IN
L	+···	····	1½	1

Figure 2-11

For bifocals, we must have both near and distance PDs. Decentration for the distance is still figured the same. For the near decentration (or bifocal inset), we subtract the near from the distance PD, divide by two (2) (2 eyes) and enter the result in the decentration for near under multifocal instructions. This will always be IN decentration because the eyes converge to read. (Figure 2-11)

Total decentration is the combination of the distance decentration and the segment inset. In our example of decentration for bifocals, we show OUT decentration for distance and IN decentration for near. The direction of total decentration is determined by the direction of the larger figure. In other words, if we had 2 mm OUT for distance and 1 1/2 mm IN for near, our total would be 1/2 mm OUT (each eye).

Total decentration may also be computed by comparing the near PD and FPD. In this example:

46 + 22 = 68 (FPD)
- 66 (near PD)
2 ÷ 2 = 1 mm IN each eye

EXERCISE II-1d

INSTRUCTIONS

Complete the following statements in the spaces provided. AFR 167-3 will be needed.

1. What cylinder form is used for ordering the following prescription categories?
   a. Single vision glass ______
   b. Single vision plastic ______
   c. Bifocals in glass ______
   d. Bifocals in plastic ______
2. What is the strongest lens prescription which can be obtained in the Aircrew spectacle frame?
______ Would the following Rx qualify?
O.D. +4.75D sph = +0.75 cx 090
O.S. +4.75D sph = +1.00 cx 090
3. What is done with spectacles that cannot be delivered or forwarded to the patient? ______
4. What is the meaning of the terms N-15 and N-31? ______
5. List the categories of personnel eligible for issue of the aircrew frame.
6. What regulation describes the persons who are authorized spectacles? ______
7. What category of Air Force personnel is authorized spectacles with non-standard frames?
8. Where is copy three of DD Form 771 filed? ______
______ What is done with copy two? ______
9. What statement is required on DD Form 771 when ordering half-eye frame spectacles?

10. A prescription order number is entered on a DD Form 771 as 1-84. What is the significance of that order number? ______________________________

____

____

COMPLETION OF EYEWEAR PRESCRIPTION FORMS

All information should be complete, accurate and legible on the eyewear prescription form, DD Form 771. It should be carefully checked to ascertain that all necessary data is present. In writing the prescription, special care must be taken to see that decimal points and plus and minus signs, as well as the figures themselves, are written clearly and correctly.

The Decimal Points

The importance of correctly placing the decimal points cannot be overemphasized. Make sure they are never omitted and are properly inserted. Always place a zero before the decimal point if a power of less than one diopter is recorded. Fractions of a diopter should always be carried out two places. Examples of the correct and incorrect use of decimal points are shown here:

EXAMPLE 1:	Correct	+0.50
	Incorrect	+ .50
EXAMPLE 2:	Correct	+1.50
	Incorrect	+1.5

The Signs

It is extremely important that the plus and minus signs be written correctly. An incorrect sign will cause the selection of an improper lens at the laboratory.

Although the following prescription may be correct, it is improperly written:

OD +2.00 +2.00 x 45
OS +2.00 -2.00 x 135

It is possible that the sign of the cylinder power of the left lens was intended to read plus instead of minus. If this were true, and the laboratory transposed the left eye and filled the Rx, the patient would not be able to wear the glasses. This is the reason the laboratory will return all Rxs not submitted with correct and complete information.

The Prescription Figures

If a prescription is obviously incorrect, it is always advisable to speak to the prescribing officer for verification. An example of an obviously incorrect prescription appears below:

OD +7.5 +0.75 x 90
OS +0.75 +0.75 x 90

The spherical power of the right lens is incorrectly written for either a lens of seven and one-half diopters or three-fourths of a diopter.

Completion Procedures

If you look at Figure 2-12, the following information pertaining to completion of DD Form 771 will be easy to follow.

1. Date: Enter order date in sequence day, month, year. Example 11 Sep 83. Mail out your clinic prescription forms daily.

2. Order Number: AFR 167-3 states that the order number is a number assigned serially (to the prescription) within the fiscal year, a hyphen and the last two digits of the fiscal year. Fiscal years begin on 1 October of each year, thus the first order you write on 1 October 1983 will be 1-84. The second order will be numbered 2-84, etc. The order number 589-84 means that this was the 589th prescription order written in FY 84.

3. To (Optical Laboratory, including Zip Code): Refer to AFR 167-3 to find out which optical laboratory(s) services your area and enter the address in this block. Some AF bases must use two different optical laboratories, one for single vision Rxs and another for multifocals. If you mail forms to two different laboratories, be sure and check each form for the correct address.

4. From (Station and Location, including Zip Code): Enter the address of your hospital eye clinic here. This tells the laboratory where to mail the finished spectacles. It may be helpful to order a name plate which can be used to stamp your address in this block.

(Another nameplate can be made for the address of the optical laboratory(s) you are using.)

5. Name, Grade, SSAN: Enter patient's last name, first name, and middle initial. Then enter rank and social security number.

6. Self explanatory.

7. Unit and Address: Place the patient's organization and address here. If the patient is retired enter his home address. It is helpful to enter phone numbers in this block.

8. Next place an X in one box (only) which designates whether the patient is Active Duty, Retired or Other.

9. Place an X in one box (only) indicating whether the patient is Army, Navy, Air Force, Public Health Service, Coast Guard or Other.

10. Spectacles: This block refers to the male S-10 plastic frame or the female S-14 frame. Place an X in the appropriate box. If you are ordering any other type of spectacle frame, e.g., aircrew, protective mask insert, half-eye, etc., do not designate male or female (Leave boxes blank). When you do order the female frame, it's very helpful to the laboratory if you further emphasize the fact in the remarks section of the DD Form 771.

11. Aviation Spectacles: Place an X in the appropriate box only if the Rx is to be supplied in an aircrew frame. Otherwise you would leave these boxes blank.

12. Other: Place an X in the appropriate box. If the Rx is neither a repair,nor for a protective mask insert, do not make an entry.

13. Interpupillary Distance: Enter patient's P.D. here. If the spectacle Rx is a multifocal, be sure you enter both the distance and near P.D. If the spectacle Rx is single vision for presbyopia, you may line out the distance P.D. box and enter only the near P.D. If you enter only one P.D., be sure to line out the other box.

14. Eye Size: Enter the frame lens size desired.

15. Bridge Size: Enter the bridge size desired.

16. Temple Length and Style: Enter the temple length (in inches) and the style, e.g., riding bow, comfort cable, etc.

17. Number Pair(s): Enter either 1 or 2 here. (Only 1 pair for retirees)

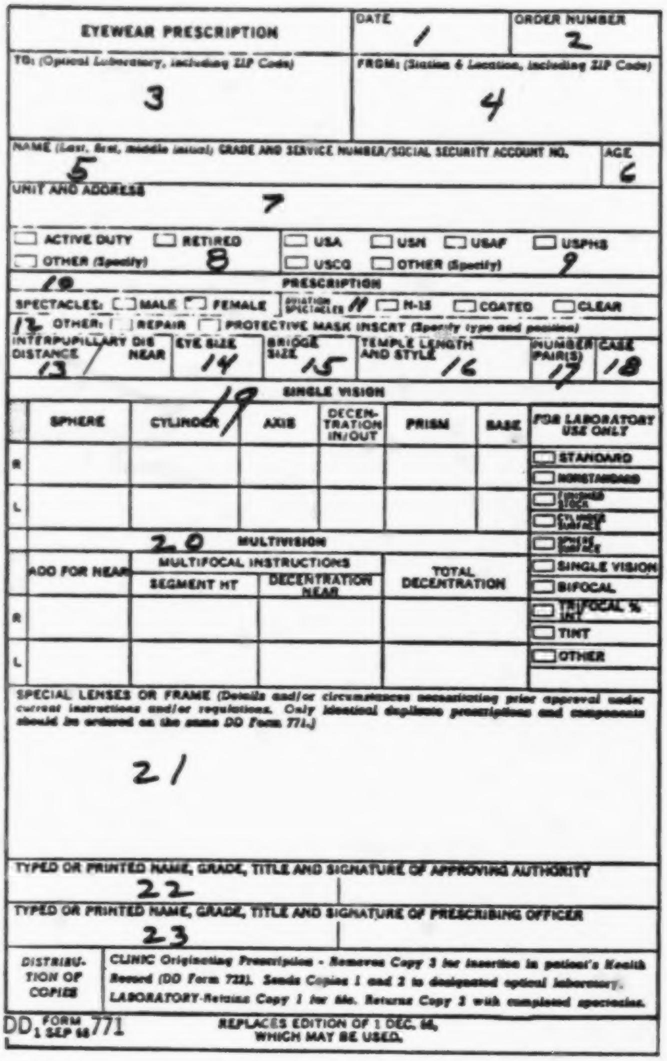
18. Case: Enter either 1 or 2 here (usually 1)

19. Single Vision and 20. Multivision: For single vision glass lenses, complete the "Single Vision" portion in minus cylinder form, transposing if necessary. If there is no sphere power, write "Plano" -- don't leave blank. If there is no cylinder power, write "Sphere" or line out the box -- don't leave blank. For a multifocal Rx, also complete the "Multivision" portion of the form. Multifocals must be ordered in minus cylinder form. Be sure to enter the add for near in the appropriate box. The segment height is the distance from the top of the multifocal segment to the inside of the lower eyewire groove. Plastic lens Rxs must be written in minus cylinder form. When prism is required, be sure to specify the base direction. (The entries required for decentration will be discussed below).

21. Special Lenses or Frames: This block may be used for any additional information required to clarify the spectacle prescription and/or for justifications. For instance, if one SPH is + and the other is -, be sure to make a comment. If the axes look strange, make a comment. If special justification is needed for the Rx, include it.

22. Approving Authority: This block normally is not used.

23. Prescribing Officer: The prescribing optometrist or ophthalmologist must sign this block. Type (or print) the name, grade, and title on the left side of the block.



EYEWEAR PRESCRIPTION

DATE 1

ORDER NUMBER 2

TO: (Optical Laboratory, including ZIP Code) 3

FROM: (Station & Location, including ZIP Code) 4

NAME (Last, first, middle initial) GRADE AND SERVICE NUMBER/SOCIAL SECURITY ACCOUNT NO. 5

AGE 6

UNIT AND ADDRESS 7

☐ ACTIVE DUTY ☐ RETIRED
☐ OTHER (Specify) 8

☐ USA ☐ USN ☐ USAF ☐ USPHS
☐ USCG ☐ OTHER (Specify) 9

10 PRESCRIPTION

SPECTACLES: ☐ MALE ☐ FEMALE

AVIATION SPECTACLES 11 ☐ N-15 ☐ COATED ☐ CLEAR

12 OTHER: ☐ REPAIR ☐ PROTECTIVE MASK INSERT (Specify type and position)

INTERPUPILLARY DISTANCE DIS / NEAR	EYE SIZE	BRIDGE SIZE	TEMPLE LENGTH AND STYLE	NUMBER PAIR(S)	CASE
13 /	14	15	16	17	18

19 SINGLE VISION

	SPHERE	CYLINDER	AXIS	DECENTRATION IN/OUT	PRISM	BASE
R						
L						

20 MULTIVISION

	ADD FOR NEAR	MULTIFOCAL INSTRUCTIONS		TOTAL DECENTRATION
		SEGMENT HT	DECENTRATION NEAR	
R				
L				

FOR LABORATORY USE ONLY
☐ STANDARD
☐ NONSTANDARD
☐ FINISHED STOCK
☐ CYLINDER SURFACE
☐ SPHERE SURFACE
☐ SINGLE VISION
☐ BIFOCAL
☐ TRIFOCAL % INT
☐ TINT
☐ OTHER

SPECIAL LENSES OR FRAME (*Details and/or circumstances necessitating prior approval under current instructions and/or regulations. Only identical duplicate prescriptions and components should be ordered on the same DD Form 771.*)

21

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF APPROVING AUTHORITY
22

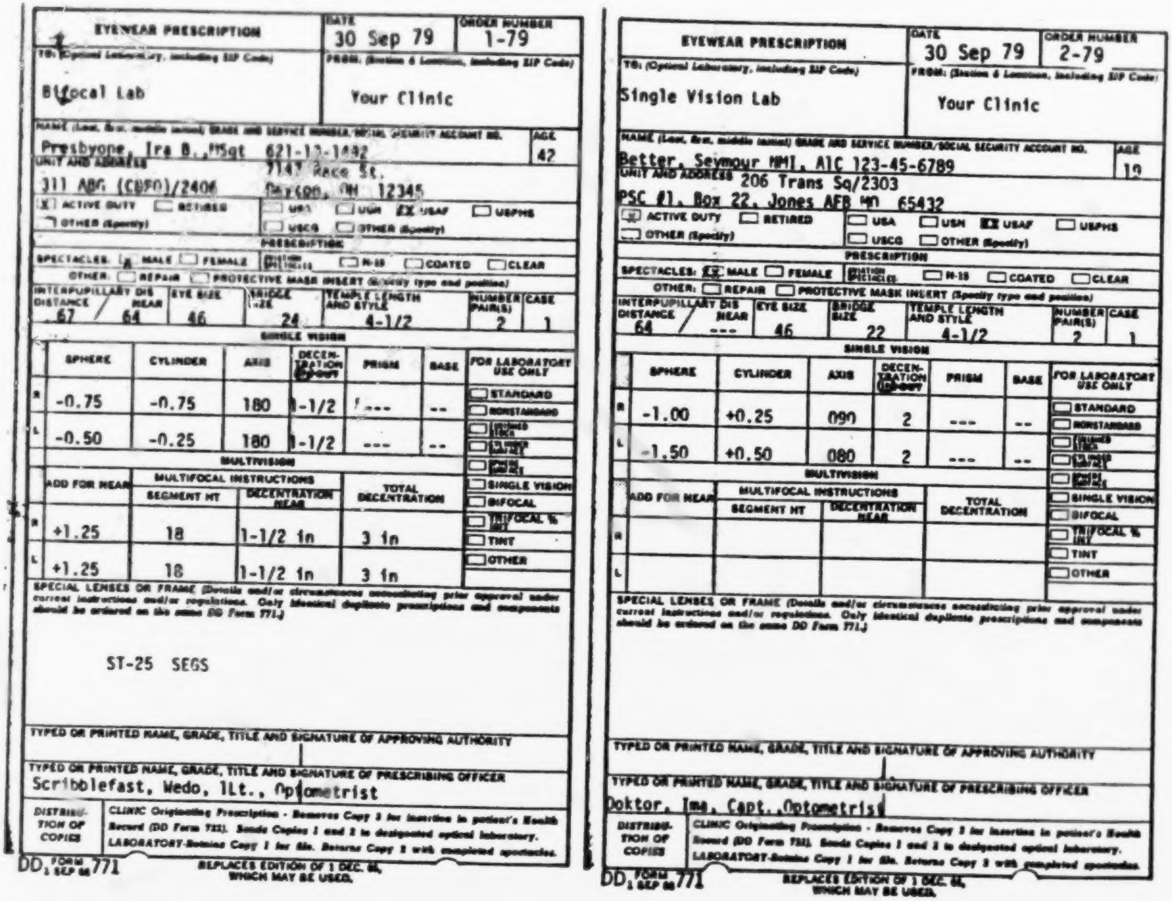
TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF PRESCRIBING OFFICER
23

DISTRIBUTION OF COPIES	CLINIC *Originating Prescription - Removes Copy 3 for insertion in patient's Health Record (DD Form 722). Sends Copies 1 and 2 to designated optical laboratory.* LABORATORY-*Retains Copy 1 for file. Returns Copy 2 with completed spectacles.*

DD FORM 1 SEP 68 771

REPLACES EDITION OF 1 DEC. 66, WHICH MAY BE USED.

Figure 2-12



EYEWEAR PRESCRIPTION	DATE 30 Sep 79	ORDER NUMBER 1-79
TO: (Optical Laboratory, including ZIP Code) Bifocal Lab	FROM: (Station & Location, including ZIP Code) Your Clinic	

NAME (Last, first, middle initial) GRADE AND SERVICE NUMBER/SOCIAL SECURITY ACCOUNT NO. Presbyope, Ira B., MSgt 621-13-1492	AGE 42
UNIT AND ADDRESS 311 ABG (CBPO)/2406 7147 Race St. Dayton, OH 12345	
☒ ACTIVE DUTY ☐ RETIRED ☐ OTHER (Specify)	☐ USA ☐ USN ☒ USAF ☐ USPHS ☐ USCG ☐ OTHER (Specify)

PRESCRIPTION

SPECTACLES: ☒ MALE ☐ FEMALE AVIATION SPECTACLES ☐ N-15 ☐ COATED ☐ CLEAR

OTHER: ☐ REPAIR ☐ PROTECTIVE MASK INSERT (Specify type and position)

INTERPUPILLARY DISTANCE DIS / NEAR	EYE SIZE	BRIDGE SIZE	TEMPLE LENGTH AND STYLE	NUMBER PAIR(S)	CASE
67 / 64	46	24	4-1/2	2	1

SINGLE VISION

	SPHERE	CYLINDER	AXIS	DECENTRATION (IN-OUT)	PRISM	BASE
R	-0.75	-0.75	180	1-1/2	---	--
L	-0.50	-0.25	180	1-1/2	---	--

MULTIVISION

	ADD FOR NEAR	MULTIFOCAL INSTRUCTIONS SEGMENT HT	MULTIFOCAL INSTRUCTIONS DECENTRATION NEAR	TOTAL DECENTRATION
R	+1.25	18	1-1/2 in	3 in
L	+1.25	18	1-1/2 in	3 in

FOR LABORATORY USE ONLY: ☐ STANDARD ☐ NONSTANDARD ☐ [illegible] ☐ [illegible] ☐ [illegible] ☐ SINGLE VISION ☐ BIFOCAL ☐ TRIFOCAL & UNIT ☐ TINT ☐ OTHER

SPECIAL LENSES OR FRAME (Details and/or circumstances necessitating prior approval under current instructions and/or regulations. Only identical duplicate prescriptions and components should be ordered on the same DD Form 771.)

ST-25 SEGS

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF APPROVING AUTHORITY

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF PRESCRIBING OFFICER
Scribblefast, Wedo, 1Lt., Optometrist

DISTRIBUTION OF COPIES: CLINIC Originating Prescription - Removes Copy 3 for insertion in patient's Health Record (DD Form 722). Sends Copies 1 and 2 to designated optical laboratory. LABORATORY-Retains Copy 1 for file. Returns Copy 2 with completed spectacles.

DD FORM 1 SEP 66 771 REPLACES EDITION OF 1 DEC. 65, WHICH MAY BE USED.

EYEWEAR PRESCRIPTION	DATE 30 Sep 79	ORDER NUMBER 2-79
TO: (Optical Laboratory, including ZIP Code) Single Vision Lab	FROM: (Station & Location, including ZIP Code) Your Clinic	

NAME (Last, first, middle initial) GRADE AND SERVICE NUMBER/SOCIAL SECURITY ACCOUNT NO. Better, Seymour NMI, A1C 123-45-6789	AGE 19
UNIT AND ADDRESS 206 Trans Sq/2303 PSC #1, Box 22, Jones AFB MO 65432	
☒ ACTIVE DUTY ☐ RETIRED ☐ OTHER (Specify)	☐ USA ☐ USN ☒ USAF ☐ USPHS ☐ USCG ☐ OTHER (Specify)

PRESCRIPTION

SPECTACLES: ☒ MALE ☐ FEMALE AVIATION SPECTACLES ☐ N-15 ☐ COATED ☐ CLEAR

OTHER: ☐ REPAIR ☐ PROTECTIVE MASK INSERT (Specify type and position)

INTERPUPILLARY DISTANCE DIS / NEAR	EYE SIZE	BRIDGE SIZE	TEMPLE LENGTH AND STYLE	NUMBER PAIR(S)	CASE
64 / ---	46	22	4-1/2	2	1

SINGLE VISION

	SPHERE	CYLINDER	AXIS	DECENTRATION (IN-OUT)	PRISM	BASE
R	-1.00	+0.25	090	2	---	--
L	-1.50	+0.50	080	2	---	--

MULTIVISION

	ADD FOR NEAR	MULTIFOCAL INSTRUCTIONS SEGMENT HT	MULTIFOCAL INSTRUCTIONS DECENTRATION NEAR	TOTAL DECENTRATION
R				
L				

FOR LABORATORY USE ONLY: ☐ STANDARD ☐ NONSTANDARD ☐ [illegible] ☐ [illegible] ☐ [illegible] ☐ SINGLE VISION ☐ BIFOCAL ☐ TRIFOCAL & UNIT ☐ TINT ☐ OTHER

SPECIAL LENSES OR FRAME (Details and/or circumstances necessitating prior approval under current instructions and/or regulations. Only identical duplicate prescriptions and components should be ordered on the same DD Form 771.)

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF APPROVING AUTHORITY

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF PRESCRIBING OFFICER
Doktor, Ima, Capt., Optometrist

DISTRIBUTION OF COPIES: CLINIC Originating Prescription - Removes Copy 3 for insertion in patient's Health Record (DD Form 722). Sends Copies 1 and 2 to designated optical laboratory. LABORATORY-Retains Copy 1 for file. Returns Copy 2 with completed spectacles.

DD FORM 1 SEP 66 771 REPLACES EDITION OF 1 DEC. 65, WHICH MAY BE USED.

Figure 2-13

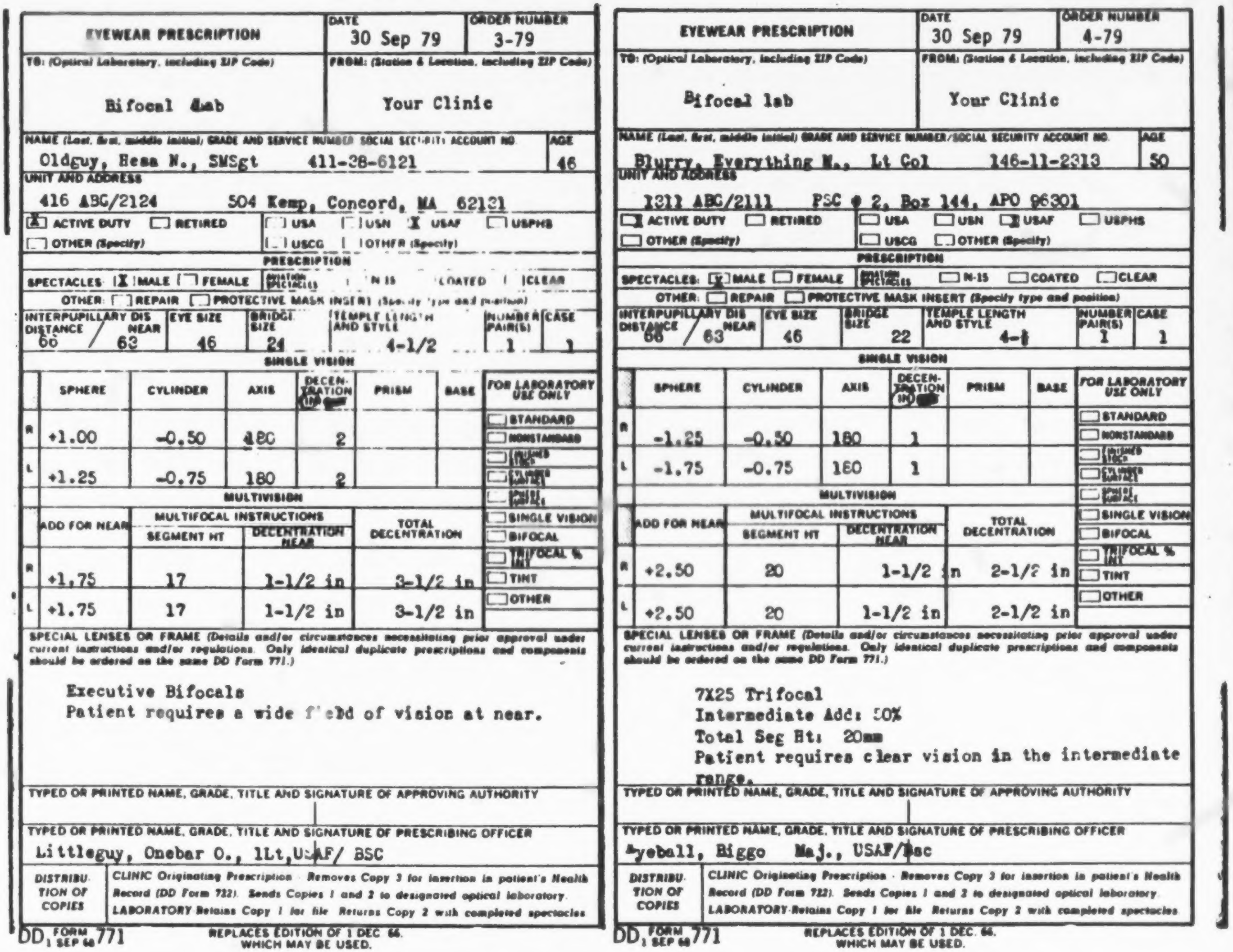


Figure 2-14

EYEWEAR PRESCRIPTION

DATE: 30 Sep 79 | ORDER NUMBER: 3-79

TO: (Optical Laboratory, including ZIP Code) Bifocal lab

FROM: (Station & Location, including ZIP Code) Your Clinic

NAME (Last, first, middle initial) GRADE AND SERVICE NUMBER/SOCIAL SECURITY ACCOUNT NO.: Oldguy, Hesa N., SMSgt 411-38-6121

AGE: 46

UNIT AND ADDRESS: 416 ABG/2124 504 Kemp, Concord, MA 62121

☒ ACTIVE DUTY ☐ RETIRED ☐ OTHER (Specify)

☐ USA ☐ USN ☒ USAF ☐ USPHS ☐ USCG ☐ OTHER (Specify)

PRESCRIPTION

SPECTACLES: ☒ MALE ☐ FEMALE AVIATION SPECTACLES ☐ N-15 ☐ COATED ☐ CLEAR

OTHER: ☐ REPAIR ☐ PROTECTIVE MASK INSERT (Specify type and position)

INTERPUPILLARY DISTANCE DIS / NEAR	EYE SIZE	BRIDGE SIZE	TEMPLE LENGTH AND STYLE	NUMBER PAIR(S)	CASE
66 / 63	46	24	4-1/2	1	1

SINGLE VISION

	SPHERE	CYLINDER	AXIS	DECENTRATION [✓ IN]	PRISM	BASE
R	+1.00	-0.50	180	2		
L	+1.25	-0.75	180	2		

MULTIVISION

	ADD FOR NEAR	MULTIFOCAL INSTRUCTIONS SEGMENT HT	MULTIFOCAL INSTRUCTIONS DECENTRATION NEAR	TOTAL DECENTRATION
R	+1.75	17	1-1/2 in	3-1/2 in
L	+1.75	17	1-1/2 in	3-1/2 in

FOR LABORATORY USE ONLY: ☐ STANDARD ☐ NONSTANDARD ☐ FINISHED STOCK ☐ CYLINDER SURFACE ☐ SPHERE SURFACE ☐ SINGLE VISION ☐ BIFOCAL ☐ TRIFOCAL % INT ☐ TINT ☐ OTHER

SPECIAL LENSES OR FRAME (Details and/or circumstances necessitating prior approval under current instructions and/or regulations. Only identical duplicate prescriptions and components should be ordered on the same DD Form 771.)

Executive Bifocals
Patient requires a wide field of vision at near.

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF APPROVING AUTHORITY

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF PRESCRIBING OFFICER: Littleguy, Onebar O., 1Lt, USAF/ BSC

DISTRIBUTION OF COPIES: CLINIC Originating Prescription - Removes Copy 3 for insertion in patient's Health Record (DD Form 722). Sends Copies 1 and 2 to designated optical laboratory. LABORATORY Retains Copy 1 for file. Returns Copy 2 with completed spectacles.

DD FORM 1 SEP 68 771 REPLACES EDITION OF 1 DEC 66, WHICH MAY BE USED.

EYEWEAR PRESCRIPTION

DATE: 30 Sep 79 | ORDER NUMBER: 4-79

TO: (Optical Laboratory, including ZIP Code) Bifocal lab

FROM: (Station & Location, including ZIP Code) Your Clinic

NAME (Last, first, middle initial) GRADE AND SERVICE NUMBER/SOCIAL SECURITY ACCOUNT NO.: Blurry, Everything M., Lt Col 146-11-2313

AGE: 50

UNIT AND ADDRESS: 1311 ABG/2111 PSC # 2, Box 144, APO 96301

☒ ACTIVE DUTY ☐ RETIRED ☐ OTHER (Specify)

☐ USA ☐ USN ☒ USAF ☐ USPHS ☐ USCG ☐ OTHER (Specify)

PRESCRIPTION

SPECTACLES: ☒ MALE ☐ FEMALE AVIATION SPECTACLES ☐ N-15 ☐ COATED ☐ CLEAR

OTHER: ☐ REPAIR ☐ PROTECTIVE MASK INSERT (Specify type and position)

INTERPUPILLARY DISTANCE DIS / NEAR	EYE SIZE	BRIDGE SIZE	TEMPLE LENGTH AND STYLE	NUMBER PAIR(S)	CASE
66 / 63	46	22	4-½	1	1

SINGLE VISION

	SPHERE	CYLINDER	AXIS	DECENTRATION [✓ IN]	PRISM	BASE
R	-1.25	-0.50	180	1		
L	-1.75	-0.75	180	1		

MULTIVISION

	ADD FOR NEAR	MULTIFOCAL INSTRUCTIONS SEGMENT HT	MULTIFOCAL INSTRUCTIONS DECENTRATION NEAR	TOTAL DECENTRATION
R	+2.50	20	1-1/2 in	2-1/2 in
L	+2.50	20	1-1/2 in	2-1/2 in

FOR LABORATORY USE ONLY: ☐ STANDARD ☐ NONSTANDARD ☐ FINISHED STOCK ☐ CYLINDER SURFACE ☐ SPHERE SURFACE ☐ SINGLE VISION ☐ BIFOCAL ☐ TRIFOCAL % INT ☐ TINT ☐ OTHER

SPECIAL LENSES OR FRAME (Details and/or circumstances necessitating prior approval under current instructions and/or regulations. Only identical duplicate prescriptions and components should be ordered on the same DD Form 771.)

7X25 Trifocal
Intermediate Add: 50%
Total Seg Ht: 20mm
Patient requires clear vision in the intermediate range.

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF APPROVING AUTHORITY

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF PRESCRIBING OFFICER: Eyeball, Biggo Maj., USAF/BSC

DISTRIBUTION OF COPIES: CLINIC Originating Prescription - Removes Copy 3 for insertion in patient's Health Record (DD Form 722). Sends Copies 1 and 2 to designated optical laboratory. LABORATORY Retains Copy 1 for file. Returns Copy 2 with completed spectacles.

DD FORM 1 SEP 68 771 REPLACES EDITION OF 1 DEC 66, WHICH MAY BE USED.

T COPY AVAILABLE

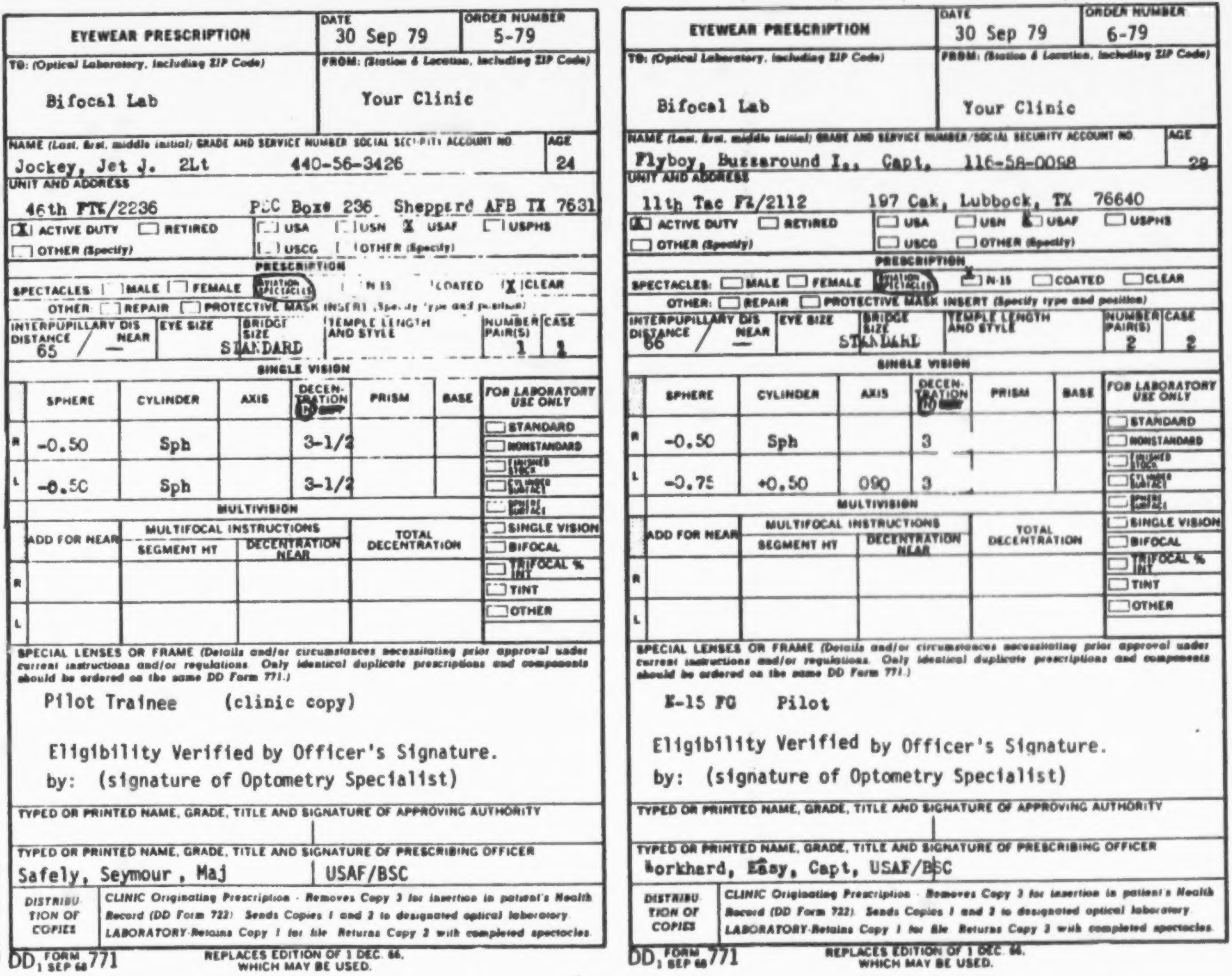


Figure 2-15

EYEWEAR PRESCRIPTION

DATE: 30 Sep 79
ORDER NUMBER: 5-79

TO: (Optical Laboratory, including ZIP Code): Bifocal Lab

FROM: (Station & Location, including ZIP Code): Your Clinic

NAME (Last, first, middle initial) GRADE AND SERVICE NUMBER SOCIAL SECURITY ACCOUNT NO: Jockey, Jet J. 2Lt 440-56-3426

AGE: 24

UNIT AND ADDRESS: 46th FTK/2236 PSC Box# 236 Sheppard AFB TX 7631

☒ ACTIVE DUTY ☐ RETIRED ☐ OTHER (Specify)

☐ USA ☐ USN ☒ USAF ☐ USPHS ☐ USCG ☐ OTHER (Specify)

PRESCRIPTION

SPECTACLES: ☐ MALE ☐ FEMALE [✓ AVIATION SPECTACLES] ☐ N-15 ☐ COATED ☒ CLEAR

OTHER: ☐ REPAIR ☐ PROTECTIVE MASK INSERT (Specify type and position)

INTERPUPILLARY DISTANCE / NEAR	EYE SIZE	BRIDGE SIZE	TEMPLE LENGTH AND STYLE	NUMBER PAIR(S)	CASE
65 / —	STANDARD			1	1

SINGLE VISION

	SPHERE	CYLINDER	AXIS	DECENTRATION [✓ IN]	PRISM	BASE
R	-0.50	Sph		3-1/2		
L	-0.50	Sph		3-1/2		

MULTIVISION

	ADD FOR NEAR	MULTIFOCAL INSTRUCTIONS SEGMENT HT	MULTIFOCAL INSTRUCTIONS DECENTRATION NEAR	TOTAL DECENTRATION
R				
L				

FOR LABORATORY USE ONLY: ☐ STANDARD ☐ NONSTANDARD ☐ FINISHED STOCK ☐ CYLINDER SURFACE ☐ SPHERE SURFACE ☐ SINGLE VISION ☐ BIFOCAL ☐ TRIFOCAL % INT ☐ TINT ☐ OTHER

SPECIAL LENSES OR FRAME (Details and/or circumstances necessitating prior approval under current instructions and/or regulations. Only identical duplicate prescriptions and components should be ordered on the same DD Form 771.)

Pilot Trainee (clinic copy)

Eligibility Verified by Officer's Signature.
by: (signature of Optometry Specialist)

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF APPROVING AUTHORITY

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF PRESCRIBING OFFICER: Safely, Seymour, Maj USAF/BSC

DISTRIBUTION OF COPIES: CLINIC Originating Prescription - Removes Copy 3 for insertion in patient's Health Record (DD Form 722). Sends Copies 1 and 2 to designated optical laboratory. LABORATORY-Retains Copy 1 for file. Returns Copy 2 with completed spectacles.

DD FORM 1 SEP 68 771 — REPLACES EDITION OF 1 DEC. 66, WHICH MAY BE USED.

EYEWEAR PRESCRIPTION

DATE: 30 Sep 79
ORDER NUMBER: 6-79

TO: (Optical Laboratory, including ZIP Code): Bifocal Lab

FROM: (Station & Location, including ZIP Code): Your Clinic

NAME (Last, first, middle initial) GRADE AND SERVICE NUMBER/SOCIAL SECURITY ACCOUNT NO: Flyboy, Buzzaround I., Capt, 116-58-0098

AGE: 29

UNIT AND ADDRESS: 11th Tac FL/2112 197 Oak, Lubbock, TX 76640

☒ ACTIVE DUTY ☐ RETIRED ☐ OTHER (Specify)

☐ USA ☐ USN ☒ USAF ☐ USPHS ☐ USCG ☐ OTHER (Specify)

PRESCRIPTION

SPECTACLES: ☐ MALE ☐ FEMALE [✓ AVIATION SPECTACLES] ☒ N-15 ☐ COATED ☐ CLEAR

OTHER: ☐ REPAIR ☐ PROTECTIVE MASK INSERT (Specify type and position)

INTERPUPILLARY DISTANCE / NEAR	EYE SIZE	BRIDGE SIZE	TEMPLE LENGTH AND STYLE	NUMBER PAIR(S)	CASE
66 / —	STANDARD			2	2

SINGLE VISION

	SPHERE	CYLINDER	AXIS	DECENTRATION [✓ IN]	PRISM	BASE
R	-0.50	Sph		3		
L	-0.75	+0.50	090	3		

MULTIVISION

	ADD FOR NEAR	MULTIFOCAL INSTRUCTIONS SEGMENT HT	MULTIFOCAL INSTRUCTIONS DECENTRATION NEAR	TOTAL DECENTRATION
R				
L				

FOR LABORATORY USE ONLY: ☐ STANDARD ☐ NONSTANDARD ☐ FINISHED STOCK ☐ CYLINDER SURFACE ☐ SPHERE SURFACE ☐ SINGLE VISION ☐ BIFOCAL ☐ TRIFOCAL % INT ☐ TINT ☐ OTHER

SPECIAL LENSES OR FRAME (Details and/or circumstances necessitating prior approval under current instructions and/or regulations. Only identical duplicate prescriptions and components should be ordered on the same DD Form 771.)

K-15 FG Pilot

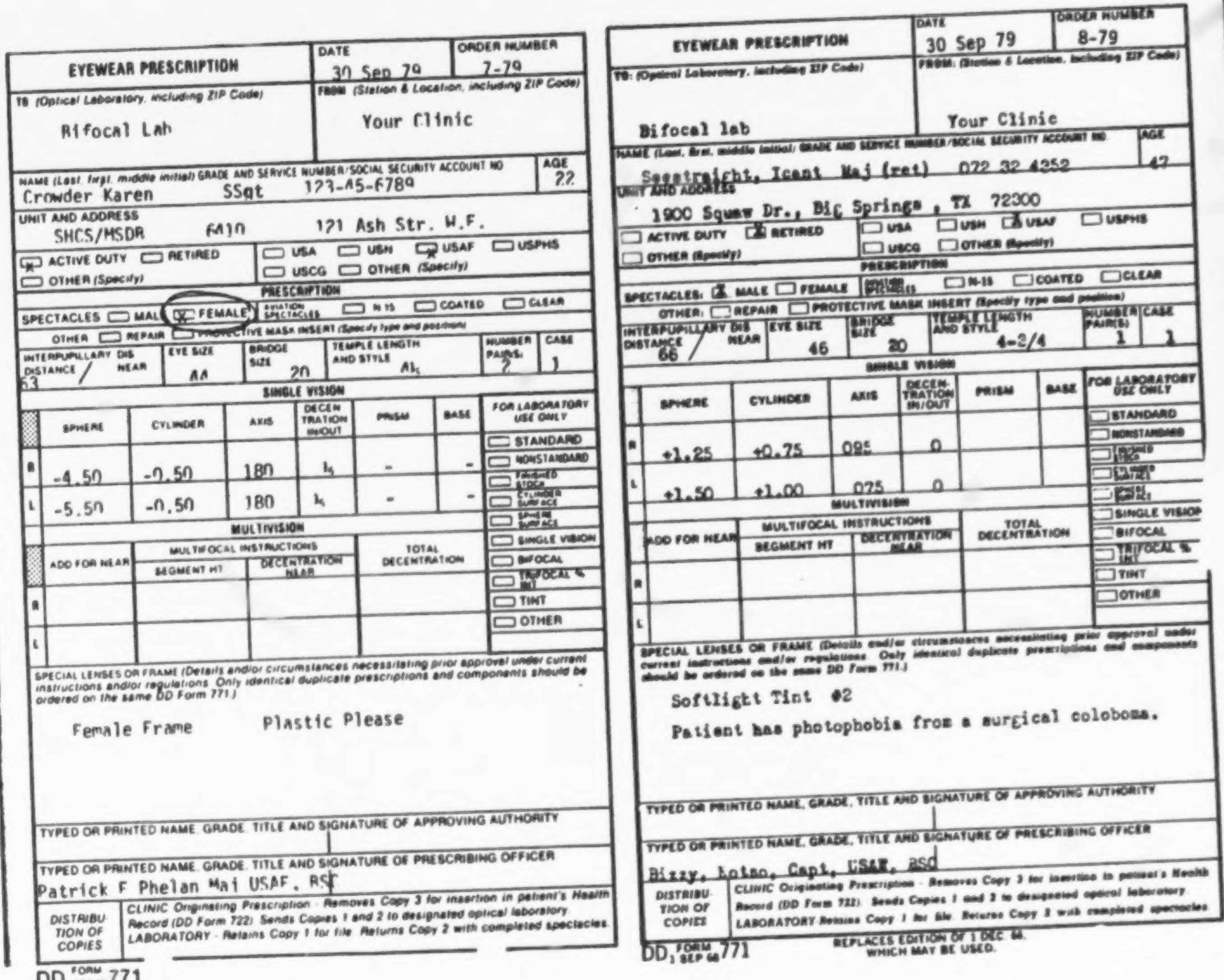
Eligibility Verified by Officer's Signature.
by: (signature of Optometry Specialist)

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF APPROVING AUTHORITY

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF PRESCRIBING OFFICER: Workhard, Easy, Capt, USAF/BSC

DISTRIBUTION OF COPIES: CLINIC Originating Prescription - Removes Copy 3 for insertion in patient's Health Record (DD Form 722). Sends Copies 1 and 2 to designated optical laboratory. LABORATORY-Retains Copy 1 for file. Returns Copy 2 with completed spectacles.

DD FORM 1 SEP 68 771 — REPLACES EDITION OF 1 DEC. 66, WHICH MAY BE USED.



EYEWEAR PRESCRIPTION

DATE: 30 Sep 79

ORDER NUMBER: 7-79

TO (Optical Laboratory, including ZIP Code): Bifocal Lab

FROM (Station & Location, including ZIP Code): Your Clinic

NAME (Last, first, middle initial) GRADE AND SERVICE NUMBER/SOCIAL SECURITY ACCOUNT NO: Crowder Karen SSgt 123-45-6789

AGE: 22

UNIT AND ADDRESS: SHCS/MSDR 6410 121 Ash Str. W.F.

☒ ACTIVE DUTY ☐ RETIRED ☐ OTHER (Specify)

☐ USA ☐ USN ☒ USAF ☐ USPHS ☐ USCG ☐ OTHER (Specify)

PRESCRIPTION

SPECTACLES ☐ MALE [✓ ☒ FEMALE] AVIATION SPECTACLES ☐ N 15 ☐ COATED ☐ CLEAR

OTHER ☐ REPAIR ☐ PROTECTIVE MASK INSERT (Specify type and position)

INTERPUPILLARY DISTANCE / NEAR	EYE SIZE	BRIDGE SIZE	TEMPLE LENGTH AND STYLE	NUMBER PAIRS	CASE
63 /	44	20	A½	2	1

SINGLE VISION

	SPHERE	CYLINDER	AXIS	DECENTRATION IN/OUT	PRISM	BASE
R	-4.50	-0.50	180	½	-	-
L	-5.50	-0.50	180	½	-	-

MULTIVISION

	ADD FOR NEAR	MULTIFOCAL INSTRUCTIONS SEGMENT HT	MULTIFOCAL INSTRUCTIONS DECENTRATION NEAR	TOTAL DECENTRATION
R				
L				

FOR LABORATORY USE ONLY
- ☐ STANDARD
- ☐ NONSTANDARD
- ☐ FINISHED STOCK
- ☐ CYLINDER SURFACE
- ☐ SPHERE SURFACE
- ☐ SINGLE VISION
- ☐ BIFOCAL
- ☐ TRIFOCAL % INT
- ☐ TINT
- ☐ OTHER

SPECIAL LENSES OR FRAME (Details and/or circumstances necessitating prior approval under current instructions and/or regulations. Only identical duplicate prescriptions and components should be ordered on the same DD Form 771.)

Female Frame Plastic Please

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF APPROVING AUTHORITY

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF PRESCRIBING OFFICER

Patrick F Phelan Maj USAF, BSC

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DD FORM 1 SEP 66 771

EYEWEAR PRESCRIPTION

DATE: 30 Sep 79

ORDER NUMBER: 8-79

TO: (Optical Laboratory, including ZIP Code): Bifocal lab

FROM: (Station & Location, including ZIP Code): Your Clinic

NAME (Last, first, middle initial) GRADE AND SERVICE NUMBER/SOCIAL SECURITY ACCOUNT NO: Seestraight, Icant Maj (ret) 072 32 4352

AGE: 47

UNIT AND ADDRESS: 1900 Squaw Dr., Big Springs, TX 72300

☐ ACTIVE DUTY ☒ RETIRED ☐ OTHER (Specify)

☐ USA ☐ USN ☒ USAF ☐ USPHS ☐ USCG ☐ OTHER (Specify)

PRESCRIPTION

SPECTACLES: ☒ MALE ☐ FEMALE AVIATION SPECTACLES ☐ N-15 ☐ COATED ☐ CLEAR

OTHER: ☐ REPAIR ☐ PROTECTIVE MASK INSERT (Specify type and position)

INTERPUPILLARY DISTANCE / NEAR	EYE SIZE	BRIDGE SIZE	TEMPLE LENGTH AND STYLE	NUMBER PAIR(S)	CASE
66 /	46	20	4-3/4	1	1

SINGLE VISION

	SPHERE	CYLINDER	AXIS	DECENTRATION IN/OUT	PRISM	BASE
R	+1.25	+0.75	095	0		
L	+1.50	+1.00	075	0		

MULTIVISION

	ADD FOR NEAR	MULTIFOCAL INSTRUCTIONS SEGMENT HT	MULTIFOCAL INSTRUCTIONS DECENTRATION NEAR	TOTAL DECENTRATION
R				
L				

FOR LABORATORY USE ONLY
- ☐ STANDARD
- ☐ NONSTANDARD
- ☐ FINISHED STOCK
- ☐ CYLINDER SURFACE
- ☐ SPHERE SURFACE
- ☐ SINGLE VISION
- ☐ BIFOCAL
- ☐ TRIFOCAL % INT
- ☐ TINT
- ☐ OTHER

SPECIAL LENSES OR FRAME (Details and/or circumstances necessitating prior approval under current instructions and/or regulations. Only identical duplicate prescriptions and components should be ordered on the same DD Form 771.)

Softlight Tint #2

Patient has photophobia from a surgical coloboma.

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF APPROVING AUTHORITY

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF PRESCRIBING OFFICER

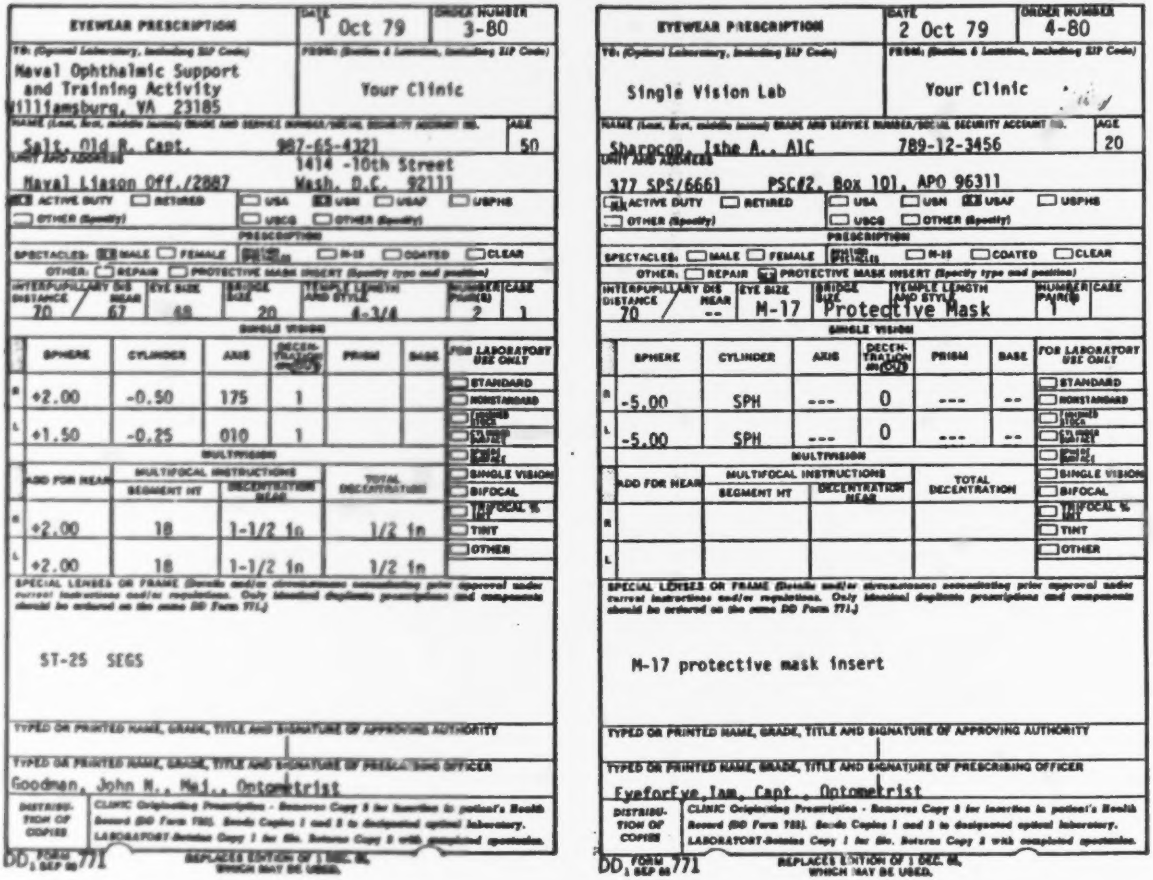
Bizzy, Lotno, Capt, USAF, BSC

DISTRIBUTION OF COPIES: CLINIC Originating Prescription - Removes Copy 3 for insertion in patient's Health Record (DD Form 722). Sends Copies 1 and 2 to designated optical laboratory. LABORATORY Retains Copy 1 for file. Returns Copy 2 with completed spectacles.

DD FORM 1 SEP 66 771

REPLACES EDITION OF 1 DEC 64, WHICH MAY BE USED.

Figure 2-16



EYEWEAR PRESCRIPTION	DATE 1 Oct 79	ORDER NUMBER 3-80

TO: (Optical Laboratory, Including ZIP Code)
Naval Ophthalmic Support
and Training Activity
Williamsburg, VA 23185

FROM: (Section & Location, Including ZIP Code)
Your Clinic

NAME (Last, first, middle initial) GRADE AND SERVICE NUMBER/SOCIAL SECURITY ACCOUNT NO.: Salt, Old B. Capt. 987-65-4321 AGE: 50

UNIT AND ADDRESS: Naval Liason Off./2887 1414 -10th Street Wash. D.C. 92111

☒ ACTIVE DUTY ☐ RETIRED ☐ OTHER (Specify) ☐ USA ☒ USN ☐ USAF ☐ USPHS ☐ USCG ☐ OTHER (Specify)

PRESCRIPTION

SPECTACLES: ☒ MALE ☐ FEMALE ☒ [illegible] ☐ [illegible] ☐ COATED ☐ CLEAR

OTHER: ☐ REPAIR ☐ PROTECTIVE MASK INSERT (Specify type and position)

INTERPUPILLARY DISTANCE	NEAR	EYE SIZE	BRIDGE SIZE	TEMPLE LENGTH AND STYLE	NUMBER PAIR(S)	CASE
70	67	48	20	4-3/4	2	1

SINGLE VISION

	SPHERE	CYLINDER	AXIS	DECENTRATION in (OUT)	PRISM	BASE
R	+2.00	-0.50	175	1		
L	+1.50	-0.25	010	1		

MULTIVISION

	ADD FOR NEAR	MULTIFOCAL INSTRUCTIONS		TOTAL DECENTRATION
		SEGMENT HT	DECENTRATION NEAR	
R	+2.00	18	1-1/2 in	1/2 in
L	+2.00	18	1-1/2 in	1/2 in

FOR LABORATORY USE ONLY
☐ STANDARD
☐ NONSTANDARD
☐ [illegible]
☐ [illegible]
☐ [illegible]
☐ SINGLE VISION
☐ BIFOCAL
☐ TRIFOCAL % SEG
☐ TINT
☐ OTHER

SPECIAL LENSES OR FRAME (Details and/or circumstances necessitating prior approval under current instructions and/or regulations. Only identical duplicate prescriptions and components should be ordered on the same DD Form 771.)

ST-25 SEGS

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF APPROVING AUTHORITY

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF PRESCRIBING OFFICER
Goodman, John M., Maj., Optometrist

DISTRIBUTION OF COPIES: CLINIC Originating Prescription - Removes Copy 3 for insertion in patient's Health Record (DD Form 722). Sends Copies 1 and 2 to designated optical laboratory. LABORATORY-Retains Copy 1 for file. Returns Copy 2 with completed spectacles.

DD FORM 1 SEP 66 771 REPLACES EDITION OF 1 DEC. 64, WHICH MAY BE USED.

EYEWEAR PRESCRIPTION	DATE 2 Oct 79	ORDER NUMBER 4-80

TO: (Optical Laboratory, Including ZIP Code)
Single Vision Lab

FROM: (Section & Location, Including ZIP Code)
Your Clinic

NAME (Last, first, middle initial) GRADE AND SERVICE NUMBER/SOCIAL SECURITY ACCOUNT NO.: Sharpcop, Ishe A., A1C 789-12-3456 AGE: 20

UNIT AND ADDRESS: 377 SPS/6661 PSC#2, Box 101, APO 96311

☒ ACTIVE DUTY ☐ RETIRED ☐ OTHER (Specify) ☐ USA ☐ USN ☒ USAF ☐ USPHS ☐ USCG ☐ OTHER (Specify)

PRESCRIPTION

SPECTACLES: ☐ MALE ☐ FEMALE ☐ [illegible] ☐ [illegible] ☐ COATED ☐ CLEAR

OTHER: ☐ REPAIR ☒ PROTECTIVE MASK INSERT (Specify type and position)

INTERPUPILLARY DISTANCE	NEAR	EYE SIZE	BRIDGE SIZE	TEMPLE LENGTH AND STYLE	NUMBER PAIR(S)	CASE
70	--	M-17	Protective Mask		1	

SINGLE VISION

	SPHERE	CYLINDER	AXIS	DECENTRATION in (OUT)	PRISM	BASE
R	-5.00	SPH	---	0	---	--
L	-5.00	SPH	---	0	---	--

MULTIVISION

	ADD FOR NEAR	MULTIFOCAL INSTRUCTIONS		TOTAL DECENTRATION
		SEGMENT HT	DECENTRATION NEAR	
R				
L				

FOR LABORATORY USE ONLY
☐ STANDARD
☐ NONSTANDARD
☐ [illegible]
☐ [illegible]
☐ [illegible]
☐ SINGLE VISION
☐ BIFOCAL
☐ TRIFOCAL % SEG
☐ TINT
☐ OTHER

SPECIAL LENSES OR FRAME (Details and/or circumstances necessitating prior approval under current instructions and/or regulations. Only identical duplicate prescriptions and components should be ordered on the same DD Form 771.)

M-17 protective mask insert

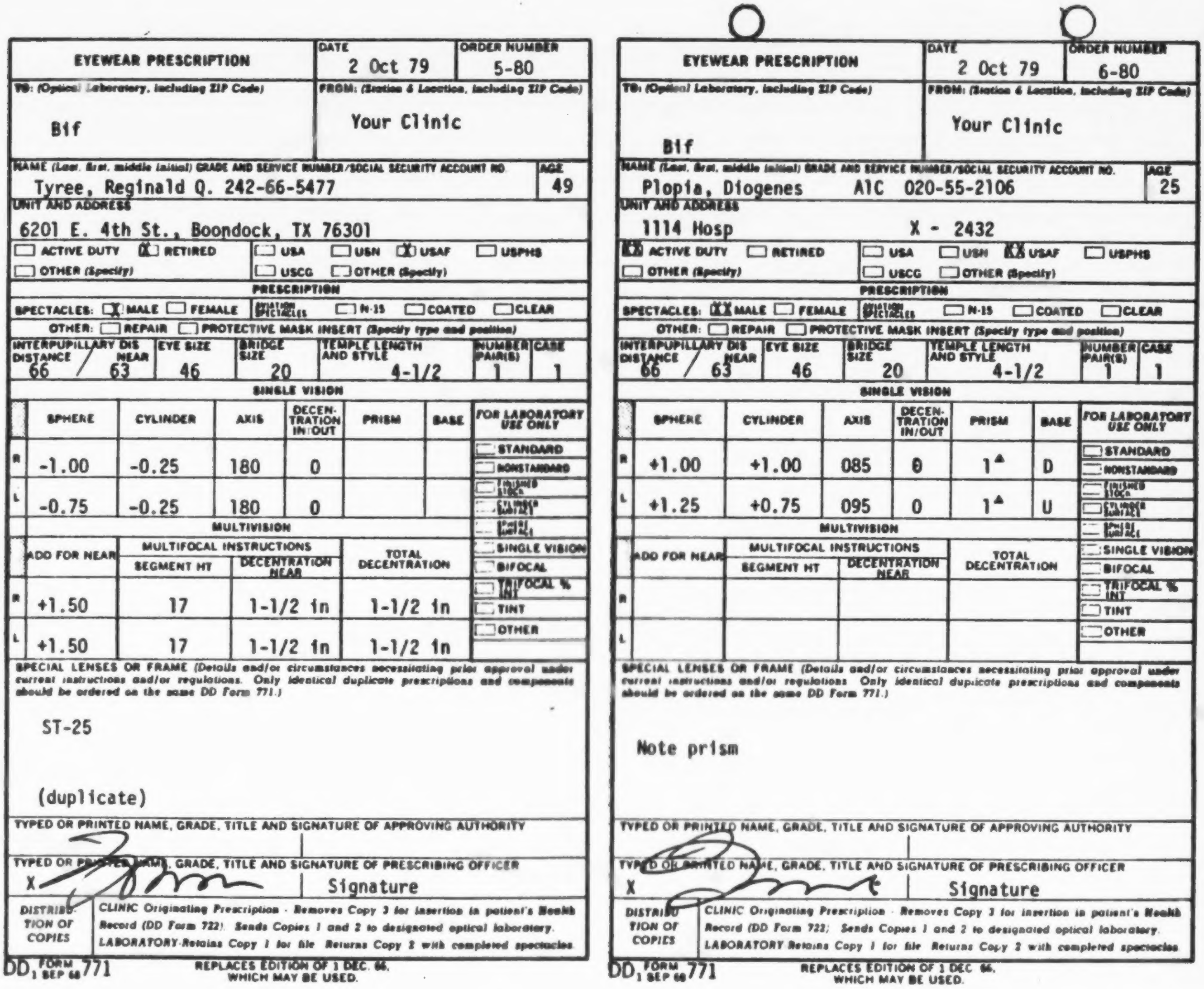
TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF APPROVING AUTHORITY

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF PRESCRIBING OFFICER
EyeforEye, Iam, Capt., Optometrist

DISTRIBUTION OF COPIES: CLINIC Originating Prescription - Removes Copy 3 for insertion in patient's Health Record (DD Form 722). Sends Copies 1 and 2 to designated optical laboratory. LABORATORY-Retains Copy 1 for file. Returns Copy 2 with completed spectacles.

DD FORM 1 SEP 66 771 REPLACES EDITION OF 1 DEC. 64, WHICH MAY BE USED.

Figure 2-18



EYEWEAR PRESCRIPTION — DATE: 2 Oct 79 — ORDER NUMBER: 5-80

TO: (Optical Laboratory, including ZIP Code) Bif

FROM: (Station & Location, including ZIP Code) Your Clinic

NAME (Last, first, middle initial) GRADE AND SERVICE NUMBER/SOCIAL SECURITY ACCOUNT NO.: Tyree, Reginald Q. 242-66-5477 — AGE: 49

UNIT AND ADDRESS: 6201 E. 4th St., Boondock, TX 76301

☐ ACTIVE DUTY ☒ RETIRED ☐ USA ☐ USN ☒ USAF ☐ USPHS

☐ OTHER (Specify) ☐ USCG ☐ OTHER (Specify)

PRESCRIPTION

SPECTACLES: ☒ MALE ☐ FEMALE AVIATION SPECTACLES ☐ N-15 ☐ COATED ☐ CLEAR

OTHER: ☐ REPAIR ☐ PROTECTIVE MASK INSERT (Specify type and position)

INTERPUPILLARY DISTANCE DIS / NEAR	EYE SIZE	BRIDGE SIZE	TEMPLE LENGTH AND STYLE	NUMBER PAIR(S)	CASE
66 / 63	46	20	4-1/2	1	1

SINGLE VISION

	SPHERE	CYLINDER	AXIS	DECENTRATION IN/OUT	PRISM	BASE
R	-1.00	-0.25	180	0		
L	-0.75	-0.25	180	0		

MULTIVISION

	ADD FOR NEAR	MULTIFOCAL INSTRUCTIONS		TOTAL DECENTRATION
		SEGMENT HT	DECENTRATION NEAR	
R	+1.50	17	1-1/2 in	1-1/2 in
L	+1.50	17	1-1/2 in	1-1/2 in

FOR LABORATORY USE ONLY
- ☐ STANDARD
- ☐ NONSTANDARD
- ☐ FINISHED STOCK
- ☐ CYLINDER SURFACE
- ☐ SPHERE SURFACE
- ☐ SINGLE VISION
- ☐ BIFOCAL
- ☐ TRIFOCAL % INT
- ☐ TINT
- ☐ OTHER

SPECIAL LENSES OR FRAME (Details and/or circumstances necessitating prior approval under current instructions and/or regulations. Only identical duplicate prescriptions and components should be ordered on the same DD Form 771.)

ST-25

(duplicate)

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF APPROVING AUTHORITY

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF PRESCRIBING OFFICER

X — Signature

DISTRIBUTION OF COPIES: CLINIC Originating Prescription - Removes Copy 3 for insertion in patient's Health Record (DD Form 722). Sends Copies 1 and 2 to designated optical laboratory. LABORATORY Retains Copy 1 for file. Returns Copy 2 with completed spectacles.

DD FORM 1 SEP 66 771 — REPLACES EDITION OF 1 DEC 66, WHICH MAY BE USED.

EYEWEAR PRESCRIPTION — DATE: 2 Oct 79 — ORDER NUMBER: 6-80

TO: (Optical Laboratory, including ZIP Code) Bif

FROM: (Station & Location, including ZIP Code) Your Clinic

NAME (Last, first, middle initial) GRADE AND SERVICE NUMBER/SOCIAL SECURITY ACCOUNT NO.: Plopia, Diogenes A1C 020-55-2106 — AGE: 25

UNIT AND ADDRESS: 1114 Hosp X - 2432

☒ ACTIVE DUTY ☐ RETIRED ☐ USA ☐ USN ☒ USAF ☐ USPHS

☐ OTHER (Specify) ☐ USCG ☐ OTHER (Specify)

PRESCRIPTION

SPECTACLES: ☒ MALE ☐ FEMALE AVIATION SPECTACLES ☐ N-15 ☐ COATED ☐ CLEAR

OTHER: ☐ REPAIR ☐ PROTECTIVE MASK INSERT (Specify type and position)

INTERPUPILLARY DISTANCE DIS / NEAR	EYE SIZE	BRIDGE SIZE	TEMPLE LENGTH AND STYLE	NUMBER PAIR(S)	CASE
66 / 63	46	20	4-1/2	1	1

SINGLE VISION

	SPHERE	CYLINDER	AXIS	DECENTRATION IN/OUT	PRISM	BASE
R	+1.00	+1.00	085	0	1▲	D
L	+1.25	+0.75	095	0	1▲	U

MULTIVISION

	ADD FOR NEAR	MULTIFOCAL INSTRUCTIONS		TOTAL DECENTRATION
		SEGMENT HT	DECENTRATION NEAR	
R				
L				

FOR LABORATORY USE ONLY
- ☐ STANDARD
- ☐ NONSTANDARD
- ☐ FINISHED STOCK
- ☐ CYLINDER SURFACE
- ☐ SPHERE SURFACE
- ☐ SINGLE VISION
- ☐ BIFOCAL
- ☐ TRIFOCAL % INT
- ☐ TINT
- ☐ OTHER

SPECIAL LENSES OR FRAME (Details and/or circumstances necessitating prior approval under current instructions and/or regulations. Only identical duplicate prescriptions and components should be ordered on the same DD Form 771.)

Note prism

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF APPROVING AUTHORITY

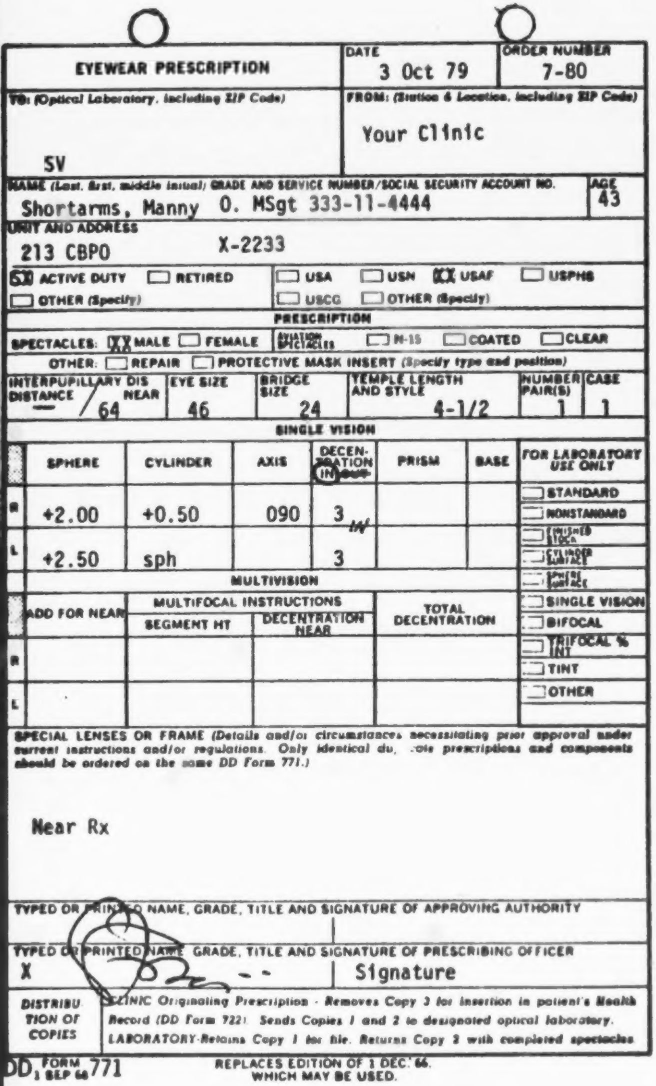
TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF PRESCRIBING OFFICER

X — Signature

DISTRIBUTION OF COPIES: CLINIC Originating Prescription - Removes Copy 3 for insertion in patient's Health Record (DD Form 722). Sends Copies 1 and 2 to designated optical laboratory. LABORATORY Retains Copy 1 for file. Returns Copy 2 with completed spectacles.

DD FORM 1 SEP 66 771 — REPLACES EDITION OF 1 DEC 66, WHICH MAY BE USED.

Figure 3-10



EYEWEAR PRESCRIPTION

DATE: 3 Oct 79

ORDER NUMBER: 7-80

TO: (Optical Laboratory, including ZIP Code): SV

FROM: (Station & Location, including ZIP Code): Your Clinic

NAME (Last, first, middle initial) GRADE AND SERVICE NUMBER/SOCIAL SECURITY ACCOUNT NO.: Shortarms, Manny O. MSgt 333-11-4444

AGE: 43

UNIT AND ADDRESS: 213 CBPO X-2233

☒ ACTIVE DUTY ☐ RETIRED ☐ USA ☐ USN ☒ USAF ☐ USPHS

☐ OTHER (Specify) ☐ USCG ☐ OTHER (Specify)

PRESCRIPTION

SPECTACLES: ☒ MALE ☐ FEMALE AVIATION SPECTACLES ☐ N-15 ☐ COATED ☐ CLEAR

OTHER: ☐ REPAIR ☐ PROTECTIVE MASK INSERT (Specify type and position)

INTERPUPILLARY DISTANCE DISTANCE / NEAR	EYE SIZE	BRIDGE SIZE	TEMPLE LENGTH AND STYLE	NUMBER PAIR(S)	CASE
— / 64	46	24	4-1/2	1	1

SINGLE VISION

	SPHERE	CYLINDER	AXIS	DECENTRATION [✓ IN] ~~OUT~~	PRISM	BASE
R	+2.00	+0.50	090	3 IN		
L	+2.50	sph		3		

MULTIVISION

	ADD FOR NEAR	MULTIFOCAL INSTRUCTIONS SEGMENT HT	MULTIFOCAL INSTRUCTIONS DECENTRATION NEAR	TOTAL DECENTRATION
R				
L				

FOR LABORATORY USE ONLY

☐ STANDARD
☐ NONSTANDARD
☐ FINISHED STOCK
☐ CYLINDER SURFACE
☐ SPHERE SURFACE
☐ SINGLE VISION
☐ BIFOCAL
☐ TRIFOCAL % INT
☐ TINT
☐ OTHER

SPECIAL LENSES OR FRAME (Details and/or circumstances necessitating prior approval under current instructions and/or regulations. Only identical duplicate prescriptions and components should be ordered on the same DD Form 771.)

Near Rx

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF APPROVING AUTHORITY

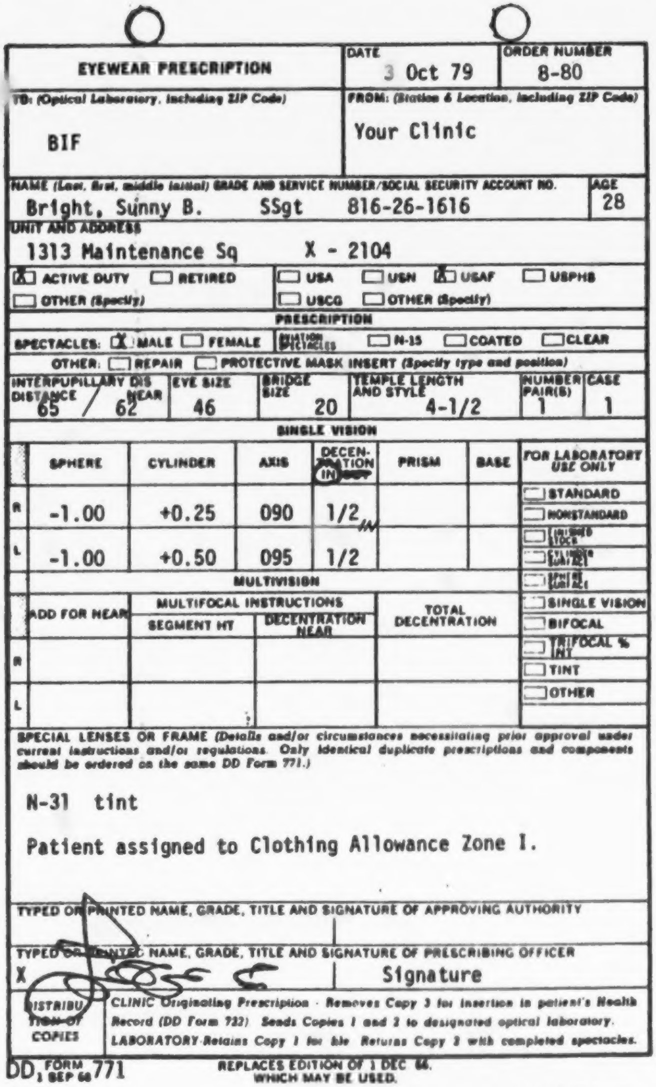
TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF PRESCRIBING OFFICER

X Signature

DISTRIBUTION OF COPIES: CLINIC Originating Prescription - Removes Copy 3 for insertion in patient's Health Record (DD Form 722). Sends Copies 1 and 2 to designated optical laboratory. LABORATORY-Retains Copy 1 for file. Returns Copy 2 with completed spectacles.

DD FORM 1 SEP 68 771

REPLACES EDITION OF 1 DEC 66, WHICH MAY BE USED.



EYEWEAR PRESCRIPTION

DATE: 3 Oct 79

ORDER NUMBER: 8-80

TO: (Optical Laboratory, including ZIP Code): BIF

FROM: (Station & Location, including ZIP Code): Your Clinic

NAME (Last, first, middle initial) GRADE AND SERVICE NUMBER/SOCIAL SECURITY ACCOUNT NO.: Bright, Sunny B. SSgt 816-26-1616

AGE: 28

UNIT AND ADDRESS: 1313 Maintenance Sq X - 2104

☒ ACTIVE DUTY ☐ RETIRED ☐ USA ☐ USN ☒ USAF ☐ USPHS

☐ OTHER (Specify) ☐ USCG ☐ OTHER (Specify)

PRESCRIPTION

SPECTACLES: ☒ MALE ☐ FEMALE AVIATION SPECTACLES ☐ N-15 ☐ COATED ☐ CLEAR

OTHER: ☐ REPAIR ☐ PROTECTIVE MASK INSERT (Specify type and position)

INTERPUPILLARY DISTANCE DISTANCE / NEAR	EYE SIZE	BRIDGE SIZE	TEMPLE LENGTH AND STYLE	NUMBER PAIR(S)	CASE
65 / 62	46	20	4-1/2	1	1

SINGLE VISION

	SPHERE	CYLINDER	AXIS	DECENTRATION [✓ IN] ~~OUT~~	PRISM	BASE
R	-1.00	+0.25	090	1/2 IN		
L	-1.00	+0.50	095	1/2		

MULTIVISION

	ADD FOR NEAR	MULTIFOCAL INSTRUCTIONS SEGMENT HT	MULTIFOCAL INSTRUCTIONS DECENTRATION NEAR	TOTAL DECENTRATION
R				
L				

FOR LABORATORY USE ONLY

☐ STANDARD
☐ NONSTANDARD
☐ FINISHED STOCK
☐ CYLINDER SURFACE
☐ SPHERE SURFACE
☐ SINGLE VISION
☐ BIFOCAL
☐ TRIFOCAL % INT
☐ TINT
☐ OTHER

SPECIAL LENSES OR FRAME (Details and/or circumstances necessitating prior approval under current instructions and/or regulations. Only identical duplicate prescriptions and components should be ordered on the same DD Form 771.)

N-31 tint

Patient assigned to Clothing Allowance Zone I.

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF APPROVING AUTHORITY

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF PRESCRIBING OFFICER

X Signature

DISTRIBUTION OF COPIES: CLINIC Originating Prescription - Removes Copy 3 for insertion in patient's Health Record (DD Form 722). Sends Copies 1 and 2 to designated optical laboratory. LABORATORY-Retains Copy 1 for file. Returns Copy 2 with completed spectacles.

DD FORM 1 SEP 68 771

REPLACES EDITION OF 1 DEC 66, WHICH MAY BE USED.

EXERCISE II-1e

INSTRUCTIONS

Complete the following problems or statements in the spaces provided:

1. Look at the information in the left hand column. If the information given is not ready for entry onto the DD 771, make the appropriate change in the right hand column.

a. O.D. + 2.0 D sph
O.S. + 2.25 D sph

b. O.D. + 1.00 D sph = -0.50 cx 180
O.S. + .75 D sph = -0.50 cx 180
Single Vision Glass

c. O.D. -7.50 D sph = +0.50 cx 90
O.S. -7.00 D sph = +0.75 cx 90
Plastic Single Vision

d. O.D. + 0.50 D sph = +1.00 cx 045
O.S. + 1.00 D sph = +0.75 cx 135
O.U. + 1.50 D add
Glass, Straight-top 25 mm

e. O.D. +1.25 D sph = -1.00 cx 065
O.S. +1.00 D sph = -0.50 cx 150
O.U. +0.75 D add
Glass, Single Vision Near Only

f. O.D. -0.50 D sph = -0.50 cx 170
O.S. +0.25 D sph = -0.75 cx 010
O.U. +1.50 D add
Glass, Single Vision Near Only

g. O.D. Plano = -0.25 cx 180
O.S. +0.25 D sph --------
O.U. + 2.00 D add
Glass, Single Vision Near Only

h. O.D. -1.00 D sph = -0.25 cx 090
O.S. -1.25 D sph = -0.25 cx 075
O.U. +1.25 D add
Glass, Single Vision Distance Only

2. Why should you not place an "X" in the MALE or FEMALE blocks of the DD Form 771 when the prescription is for aircrew spectacles?

3. When ordering the plastic female frame, what helpful information can you add into the REMARKS section of the DD 771?

____

____

4. Who normally signs the DD 771? ________________________

5. What is a DD Form 771? ____________________________

____

____

EXERCISE II-1f

INSTRUCTIONS

The following pages provide you with a sufficient number of blank forms to "order" the following spectacles. On each form, identify the laboratory you will be using at your PCS clinic. Use any name or unit for the patient. Include necessary justifications and signatures. Remember, each spectacle order must have a separate DD Form 771 completed even though multiple forms may be required for the same patient.

1. O.D. +2.00 D sph = -1.00 cx 180
   O.S. +1.50 D sph = -0.75 cx 180
   66/63 46-22-4-1/2
   AF pilot
   ORDER: 1 pr S-10
   2 pr aircrew, clear coated
   2 pr aircrew, N-15

2. O.D. -1.00 D sph = -0.75 cx 165
   O.S. -1.25 D sph = -0.50 cx 045
   64/61 44-22-4-1/2
   USCG CBM Ret.
   ORDER: 1 pr zyl

3. O.D. +1.00 D sph
   O.S. +1.50 D sph = -0.50 cx 180
   64/61 46-22-4-1/2
   AF Active Duty
   ORDER: 1 pr half-eye

4. O.D. +0.75 D sph = -0.25 cx 165
   O.S. +0.50 D sph = -0.50 cx 015
   O.U. add +1.25 Seg Ht 16 mm O.U.
   66/63 46-24-4-3/4
   AF Active Duty
   ORDER: 1 pr S-10 with ST bifocals
   1 pr half-eye

5. O.D. -1.00 D sph
O.S. -1.25 D sph = -0.25 cx 030
66/63 46-20-4-1/4
AF Missile Crew Chief
ORDER: 1 pr zyl
1 pr zyl with comfort cables

6. O.D. +0.75 D sph = -2.00 cx 175
O.S. +0.50 D sph = -1.50 cx 005
65/62 48-22-4-3/4
AF Active Duty, Clothing Allowance Zone I
ORDER: 2 pr zyl
1 pr zyl N-31

7. O.D. -4.00 D sph = -1.00 cx 080
O.S. -4.50 D sph = -0.50 cx 100
P.D. 70 Wide-central/50-22-4-3/4
Army MP
ORDER: 1 pr M-17 protective mask insert
2 pr zyl with plastic lenses

8. O.D. +2.00 D sph = -0.50 cx 015
O.S. +1.75 D sph = -0.50 cx 020
O.U. Add + 1.50 Seg. HT. 20 mm
69/65 46-24-4-1/2
Army
ORDER: 1 pr Executive bifocals
1 pr SV near only, S-10

9. O.D. +1.75 D sph
O.S. +2.25 D sph
O.U. Add +2.25
70/66 48-20-4-1/2
AF Active
ORDER: 1 pr 7 x 25 ST trifocals with 50% intermediate. Place segs 23 mm high

10. O.D. -0.75 D sph = -0.25 cx 090
O.S. -0.75 D sph = -0.25 cx 075
O.U. Add +1.25 ST-25 bifocals
62/59 44-22-4-1/4 Segs 14 mm high
ORDER: 1 pr S-10 in bifocals
1 pr S-10 SV distance only

PROBLEM NO. 1

EYEWEAR PRESCRIPTION	DATE	ORDER NUMBER
TO: *(Optical Laboratory, including ZIP Code)*	FROM: *(Station & Location, including ZIP Code)*	

NAME *(Last, first, middle initial)* GRADE AND SERVICE NUMBER/SOCIAL SECURITY ACCOUNT NO.	AGE
UNIT AND ADDRESS	
☐ ACTIVE DUTY ☐ RETIRED ☐ OTHER *(Specify)*	☐ USA ☐ USN ☐ USAF ☐ USPHS ☐ USCG ☐ OTHER *(Specify)*

PRESCRIPTION

SPECTACLES: ☐ MALE ☐ FEMALE | AVIATION SPECTACLES ☐ N-15 ☐ COATED ☐ CLEAR

OTHER: ☐ REPAIR ☐ PROTECTIVE MASK INSERT *(Specify type and position)*

INTERPUPILLARY DISTANCE DIS / NEAR	EYE SIZE	BRIDGE SIZE	TEMPLE LENGTH AND STYLE	NUMBER PAIR(S)	CASE

SINGLE VISION

	SPHERE	CYLINDER	AXIS	DECENTRATION IN/OUT	PRISM	BASE
R						
L						

MULTIVISION

	ADD FOR NEAR	MULTIFOCAL INSTRUCTIONS		TOTAL DECENTRATION
		SEGMENT HT	DECENTRATION NEAR	
R				
L				

FOR LABORATORY USE ONLY
☐ STANDARD
☐ NONSTANDARD
☐ FINISHED STOCK
☐ CYLINDER SURFACE
☐ SPHERE SURFACE
☐ SINGLE VISION
☐ BIFOCAL
☐ TRIFOCAL % TINT
☐ TINT
☐ OTHER

SPECIAL LENSES OR FRAME *(Details and/or circumstances necessitating prior approval under current instructions and/or regulations. Only identical duplicate prescriptions and components should be ordered on the same DD Form 771.)*

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF APPROVING AUTHORITY

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF PRESCRIBING OFFICER

DISTRIBUTION OF COPIES	CLINIC Originating Prescription - *Removes Copy 3 for insertion in patient's Health Record (DD Form 722). Sends Copies 1 and 2 to designated optical laboratory.* LABORATORY-*Retains Copy 1 for file. Returns Copy 2 with completed spectacles.*

DD FORM 1 SEP 66 771 — REPLACES EDITION OF 1 DEC. 64, WHICH MAY BE USED.

PROBLEM No. 1

EYEWEAR PRESCRIPTION	DATE	ORDER NUMBER
TO: *(Optical Laboratory, including ZIP Code)*	FROM: *(Station & Location, including ZIP Code)*	

NAME *(Last, first, middle initial)* GRADE AND SERVICE NUMBER/SOCIAL SECURITY ACCOUNT NO.	AGE
UNIT AND ADDRESS	
☐ ACTIVE DUTY ☐ RETIRED ☐ OTHER *(Specify)*	☐ USA ☐ USN ☐ USAF ☐ USPHS ☐ USCG ☐ OTHER *(Specify)*

PRESCRIPTION

SPECTACLES: ☐ MALE ☐ FEMALE | AVIATION SPECTACLES ☐ N-15 ☐ COATED ☐ CLEAR

OTHER: ☐ REPAIR ☐ PROTECTIVE MASK INSERT *(Specify type and position)*

INTERPUPILLARY DISTANCE DIS / NEAR	EYE SIZE	BRIDGE SIZE	TEMPLE LENGTH AND STYLE	NUMBER PAIR(S)	CASE

SINGLE VISION

	SPHERE	CYLINDER	AXIS	DECENTRATION IN/OUT	PRISM	BASE
R						
L						

MULTIVISION

	ADD FOR NEAR	MULTIFOCAL INSTRUCTIONS		TOTAL DECENTRATION
		SEGMENT HT	DECENTRATION NEAR	
R				
L				

FOR LABORATORY USE ONLY
☐ STANDARD
☐ NONSTANDARD
☐ FINISHED STOCK
☐ CYLINDER SURFACE
☐ SPHERE SURFACE
☐ SINGLE VISION
☐ BIFOCAL
☐ TRIFOCAL % TINT
☐ TINT
☐ OTHER

SPECIAL LENSES OR FRAME *(Details and/or circumstances necessitating prior approval under current instructions and/or regulations. Only identical duplicate prescriptions and components should be ordered on the same DD Form 771.)*

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF APPROVING AUTHORITY

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF PRESCRIBING OFFICER

DISTRIBUTION OF COPIES	CLINIC Originating Prescription - *Removes Copy 3 for insertion in patient's Health Record (DD Form 722). Sends Copies 1 and 2 to designated optical laboratory.* LABORATORY-*Retains Copy 1 for file. Returns Copy 2 with completed spectacles.*

DD FORM 1 SEP 66 771 — REPLACES EDITION OF 1 DEC. 64, WHICH MAY BE USED.

Figure 2-22

1-32

PROBLEM NO. 1

EYEWEAR PRESCRIPTION

DATE

ORDER NUMBER

TO: *(Optical Laboratory, including ZIP Code)*

FROM: *(Station & Location, including ZIP Code)*

NAME *(Last, first, middle initial)* GRADE AND SERVICE NUMBER/SOCIAL SECURITY ACCOUNT NO.

AGE

UNIT AND ADDRESS

☐ ACTIVE DUTY ☐ RETIRED ☐ USA ☐ USN ☐ USAF ☐ USPHS

☐ OTHER *(Specify)* ☐ USCG ☐ OTHER *(Specify)*

PRESCRIPTION

SPECTACLES: ☐ MALE ☐ FEMALE AVIATION SPECTACLES ☐ N-15 ☐ COATED ☐ CLEAR

OTHER: ☐ REPAIR ☐ PROTECTIVE MASK INSERT *(Specify type and position)*

INTERPUPILLARY DISTANCE DIS / NEAR	EYE SIZE	BRIDGE SIZE	TEMPLE LENGTH AND STYLE	NUMBER PAIR(S)	CASE

SINGLE VISION

	SPHERE	CYLINDER	AXIS	DECENTRATION IN/OUT	PRISM	BASE	FOR LABORATORY USE ONLY
R							☐ STANDARD ☐ NONSTANDARD
L							☐ FINISHED STOCK ☐ CYLINDER SURFACE

MULTIVISION

	ADD FOR NEAR	MULTIFOCAL INSTRUCTIONS		TOTAL DECENTRATION	FOR LABORATORY USE ONLY
		SEGMENT HT	DECENTRATION NEAR		☐ SPHERE SURFACE ☐ SINGLE VISION ☐ BIFOCAL
R					☐ TRIFOCAL % INT ☐ TINT
L					☐ OTHER

SPECIAL LENSES OR FRAME *(Details and/or circumstances necessitating prior approval under current instructions and/or regulations. Only identical duplicate prescriptions and components should be ordered on the same DD Form 771.)*

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF APPROVING AUTHORITY

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF PRESCRIBING OFFICER

DISTRIBUTION OF COPIES	CLINIC Originating Prescription - Removes Copy 3 for insertion in patient's Health Record (DD Form 722). Sends Copies 1 and 2 to designated optical laboratory. LABORATORY-Retains Copy 1 for file. Returns Copy 2 with completed spectacles.

DD FORM 1 SEP 68 771

REPLACES EDITION OF 1 DEC. 64,
WHICH MAY BE USED.

PROBLEM NO. 2

EYEWEAR PRESCRIPTION

DATE

ORDER NUMBER

TO: *(Optical Laboratory, including ZIP Code)*

FROM: *(Station & Location, including ZIP Code)*

NAME *(Last, first, middle initial)* GRADE AND SERVICE NUMBER/SOCIAL SECURITY ACCOUNT NO.

AGE

UNIT AND ADDRESS

☐ ACTIVE DUTY ☐ RETIRED ☐ USA ☐ USN ☐ USAF ☐ USPHS

☐ OTHER *(Specify)* ☐ USCG ☐ OTHER *(Specify)*

PRESCRIPTION

SPECTACLES: ☐ MALE ☐ FEMALE AVIATION SPECTACLES ☐ N-15 ☐ COATED ☐ CLEAR

OTHER: ☐ REPAIR ☐ PROTECTIVE MASK INSERT *(Specify type and position)*

INTERPUPILLARY DISTANCE DIS / NEAR	EYE SIZE	BRIDGE SIZE	TEMPLE LENGTH AND STYLE	NUMBER PAIR(S)	CASE

SINGLE VISION

	SPHERE	CYLINDER	AXIS	DECENTRATION IN/OUT	PRISM	BASE	FOR LABORATORY USE ONLY
R							☐ STANDARD ☐ NONSTANDARD
L							☐ FINISHED STOCK ☐ CYLINDER SURFACE

MULTIVISION

	ADD FOR NEAR	MULTIFOCAL INSTRUCTIONS		TOTAL DECENTRATION	FOR LABORATORY USE ONLY
		SEGMENT HT	DECENTRATION NEAR		☐ SPHERE SURFACE ☐ SINGLE VISION ☐ BIFOCAL
R					☐ TRIFOCAL % INT ☐ TINT
L					☐ OTHER

SPECIAL LENSES OR FRAME *(Details and/or circumstances necessitating prior approval under current instructions and/or regulations. Only identical duplicate prescriptions and components should be ordered on the same DD Form 771.)*

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF APPROVING AUTHORITY

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF PRESCRIBING OFFICER

DISTRIBUTION OF COPIES	CLINIC Originating Prescription - Removes Copy 3 for insertion in patient's Health Record (DD Form 722). Sends Copies 1 and 2 to designated optical laboratory. LABORATORY-Retains Copy 1 for file. Returns Copy 2 with completed spectacles.

DD FORM 1 SEP 68 771

REPLACES EDITION OF 1 DEC. 64,
WHICH MAY BE USED.

PROBLEM NO. 3

EYEWEAR PRESCRIPTION	DATE	ORDER NUMBER
TO: (Optical Laboratory, including ZIP Code)	FROM: (Station & Location, including ZIP Code)	
NAME (Last, first, middle initial) GRADE AND SERVICE NUMBER/SOCIAL SECURITY ACCOUNT NO.	AGE	
UNIT AND ADDRESS		

☐ ACTIVE DUTY ☐ RETIRED ☐ USA ☐ USN ☐ USAF ☐ USPHS
☐ OTHER (Specify) ☐ USCG ☐ OTHER (Specify)

PRESCRIPTION

SPECTACLES: ☐ MALE ☐ FEMALE AVIATION SPECTACLES ☐ N-15 ☐ COATED ☐ CLEAR
OTHER: ☐ REPAIR ☐ PROTECTIVE MASK INSERT (Specify type and position)

INTERPUPILLARY DISTANCE DIS / NEAR	EYE SIZE	BRIDGE SIZE	TEMPLE LENGTH AND STYLE	NUMBER PAIR(S)	CASE

SINGLE VISION

	SPHERE	CYLINDER	AXIS	DECENTRATION IN/OUT	PRISM	BASE	FOR LABORATORY USE ONLY
R							☐ STANDARD ☐ NONSTANDARD
L							☐ FINISHED STOCK ☐ CYLINDER SURFACE ☐ SPHERE SURFACE

MULTIVISION

	ADD FOR NEAR	MULTIFOCAL INSTRUCTIONS		TOTAL DECENTRATION	
		SEGMENT HT	DECENTRATION NEAR		☐ SINGLE VISION ☐ BIFOCAL
R					☐ TRIFOCAL % INT ☐ TINT
L					☐ OTHER

SPECIAL LENSES OR FRAME *(Details and/or circumstances necessitating prior approval under current instructions and/or regulations. Only identical duplicate prescriptions and components should be ordered on the same DD Form 771.)*

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF APPROVING AUTHORITY

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF PRESCRIBING OFFICER

DISTRIBUTION OF COPIES	*CLINIC Originating Prescription - Removes Copy 3 for insertion in patient's Health Record (DD Form 722). Sends Copies 1 and 2 to designated optical laboratory. LABORATORY-Retains Copy 1 for file. Returns Copy 2 with completed spectacles.*

DD FORM 1 SEP 68 771 REPLACES EDITION OF 1 DEC. 66, WHICH MAY BE USED.

PROBLEM NO. 4

EYEWEAR PRESCRIPTION	DATE	ORDER NUMBER
TO: (Optical Laboratory, including ZIP Code)	FROM: (Station & Location, including ZIP Code)	
NAME (Last, first, middle initial) GRADE AND SERVICE NUMBER/SOCIAL SECURITY ACCOUNT NO.	AGE	
UNIT AND ADDRESS		

☐ ACTIVE DUTY ☐ RETIRED ☐ USA ☐ USN ☐ USAF ☐ USPHS
☐ OTHER (Specify) ☐ USCG ☐ OTHER (Specify)

PRESCRIPTION

SPECTACLES: ☐ MALE ☐ FEMALE AVIATION SPECTACLES ☐ N-15 ☐ COATED ☐ CLEAR
OTHER: ☐ REPAIR ☐ PROTECTIVE MASK INSERT (Specify type and position)

INTERPUPILLARY DISTANCE DIS / NEAR	EYE SIZE	BRIDGE SIZE	TEMPLE LENGTH AND STYLE	NUMBER PAIR(S)	CASE

SINGLE VISION

	SPHERE	CYLINDER	AXIS	DECENTRATION IN/OUT	PRISM	BASE	FOR LABORATORY USE ONLY
R							☐ STANDARD ☐ NONSTANDARD
L							☐ FINISHED STOCK ☐ CYLINDER SURFACE ☐ SPHERE SURFACE

MULTIVISION

	ADD FOR NEAR	MULTIFOCAL INSTRUCTIONS		TOTAL DECENTRATION	
		SEGMENT HT	DECENTRATION NEAR		☐ SINGLE VISION ☐ BIFOCAL
R					☐ TRIFOCAL % INT ☐ TINT
L					☐ OTHER

SPECIAL LENSES OR FRAME *(Details and/or circumstances necessitating prior approval under current instructions and/or regulations. Only identical duplicate prescriptions and components should be ordered on the same DD Form 771.)*

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF APPROVING AUTHORITY

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF PRESCRIBING OFFICER

DISTRIBUTION OF COPIES	*CLINIC Originating Prescription - Removes Copy 3 for insertion in patient's Health Record (DD Form 722). Sends Copies 1 and 2 to designated optical laboratory. LABORATORY-Retains Copy 1 for file. Returns Copy 2 with completed spectacles.*

DD FORM 1 SEP 68 771 REPLACES EDITION OF 1 DEC. 66, WHICH MAY BE USED.

Figure 2-23

BEST COPY AVAILABLE

PROBLEM NO. 4

EYEWEAR PRESCRIPTION	DATE	ORDER NUMBER
TO: *(Optical Laboratory, including ZIP Code)*	FROM: *(Station & Location, including ZIP Code)*	
NAME *(Last, first, middle initial)* GRADE AND SERVICE NUMBER/SOCIAL SECURITY ACCOUNT NO.		AGE
UNIT AND ADDRESS		
☐ ACTIVE DUTY ☐ RETIRED ☐ OTHER *(Specify)*	☐ USA ☐ USN ☐ USAF ☐ USPHS ☐ USCG ☐ OTHER *(Specify)*	

PRESCRIPTION

SPECTACLES: ☐ MALE ☐ FEMALE | AVIATION SPECTACLES ☐ N-15 ☐ COATED ☐ CLEAR

OTHER: ☐ REPAIR ☐ PROTECTIVE MASK INSERT *(Specify type and position)*

INTERPUPILLARY DISTANCE DIS / NEAR	EYE SIZE	BRIDGE SIZE	TEMPLE LENGTH AND STYLE	NUMBER PAIR(S)	CASE

SINGLE VISION

	SPHERE	CYLINDER	AXIS	DECENTRATION IN/OUT	PRISM	BASE	FOR LABORATORY USE ONLY
R							☐ STANDARD ☐ NONSTANDARD
L							☐ FINISHED STOCK ☐ CYLINDER SURFACE ☐ SPHERE SURFACE

MULTIVISION

	ADD FOR NEAR	MULTIFOCAL INSTRUCTIONS		TOTAL DECENTRATION	
		SEGMENT HT	DECENTRATION NEAR		☐ SINGLE VISION ☐ BIFOCAL
R					☐ TRIFOCAL % INT ☐ TINT
L					☐ OTHER

SPECIAL LENSES OR FRAME *(Details and/or circumstances necessitating prior approval under current instructions and/or regulations. Only identical duplicate prescriptions and components should be ordered on the same DD Form 771.)*

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF APPROVING AUTHORITY

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF PRESCRIBING OFFICER

DISTRIBUTION OF COPIES	*CLINIC Originating Prescription - Removes Copy 3 for insertion in patient's Health Record (DD Form 722). Sends Copies 1 and 2 to designated optical laboratory.* *LABORATORY-Retains Copy 1 for file. Returns Copy 2 with completed spectacles.*

DD FORM 1 SEP 68 771 REPLACES EDITION OF 1 DEC. 66, WHICH MAY BE USED.

PROBLEM NO. 5

EYEWEAR PRESCRIPTION	DATE	ORDER NUMBER
TO: *(Optical Laboratory, including ZIP Code)*	FROM: *(Station & Location, including ZIP Code)*	
NAME *(Last, first, middle initial)* GRADE AND SERVICE NUMBER SOCIAL SECURITY ACCOUNT NO.		AGE
UNIT AND ADDRESS		
☐ ACTIVE DUTY ☐ RETIRED ☐ OTHER *(Specify)*	☐ USA ☐ USN ☐ USAF ☐ USPHS ☐ USCG ☐ OTHER *(Specify)*	

PRESCRIPTION

SPECTACLES: ☐ MALE ☐ FEMALE | AVIATION SPECTACLES ☐ N-15 ☐ COATED ☐ CLEAR

OTHER: ☐ REPAIR ☐ PROTECTIVE MASK INSERT *(Specify type and position)*

INTERPUPILLARY DISTANCE DIS / NEAR	EYE SIZE	BRIDGE SIZE	TEMPLE LENGTH AND STYLE	NUMBER PAIR(S)	CASE

SINGLE VISION

	SPHERE	CYLINDER	AXIS	DECENTRATION IN/OUT	PRISM	BASE	FOR LABORATORY USE ONLY
R							☐ STANDARD ☐ NONSTANDARD
L							☐ FINISHED STOCK ☐ CYLINDER SURFACE ☐ SPHERE SURFACE

MULTIVISION

	ADD FOR NEAR	MULTIFOCAL INSTRUCTIONS		TOTAL DECENTRATION	
		SEGMENT HT	DECENTRATION NEAR		☐ SINGLE VISION ☐ BIFOCAL
R					☐ TRIFOCAL % INT ☐ TINT
L					☐ OTHER

SPECIAL LENSES OR FRAME *(Details and/or circumstances necessitating prior approval under current instructions and/or regulations. Only identical duplicate prescriptions and components should be ordered on the same DD Form 771.)*

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF APPROVING AUTHORITY

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF PRESCRIBING OFFICER

DISTRIBUTION OF COPIES	*CLINIC Originating Prescription - Removes Copy 3 for insertion in patient's Health Record (DD Form 722). Sends Copies 1 and 2 to designated optical laboratory.* *LABORATORY-Retains Copy 1 for file. Returns Copy 2 with completed spectacles.*

DD FORM 1 SEP 68 771 REPLACES EDITION OF 1 DEC. 66, WHICH MAY BE USED.

Figure 2-24

I-34

Figure 2-25

PROBLEM NO. 5

EYEWEAR PRESCRIPTION	DATE	ORDER NUMBER
TO: *(Optical Laboratory, including ZIP Code)*	FROM: *(Station & Location, including ZIP Code)*	
NAME *(Last, first, middle initial)* GRADE AND SERVICE NUMBER/SOCIAL SECURITY ACCOUNT NO.		AGE
UNIT AND ADDRESS		

☐ ACTIVE DUTY ☐ RETIRED ☐ OTHER *(Specify)*

☐ USA ☐ USN ☐ USAF ☐ USPHS ☐ USCG ☐ OTHER *(Specify)*

PRESCRIPTION

SPECTACLES: ☐ MALE ☐ FEMALE AVIATION SPECTACLES ☐ N-15 ☐ COATED ☐ CLEAR

OTHER: ☐ REPAIR ☐ PROTECTIVE MASK INSERT *(Specify type and position)*

INTERPUPILLARY DISTANCE DIS / NEAR	EYE SIZE	BRIDGE SIZE	TEMPLE LENGTH AND STYLE	NUMBER PAIR(S)	CASE

SINGLE VISION

	SPHERE	CYLINDER	AXIS	DECENTRATION IN/OUT	PRISM	BASE	FOR LABORATORY USE ONLY
R							☐ STANDARD ☐ NONSTANDARD
L							☐ FINISHED STOCK ☐ CYLINDER SURFACE

MULTIVISION

	ADD FOR NEAR	MULTIFOCAL INSTRUCTIONS SEGMENT HT	MULTIFOCAL INSTRUCTIONS DECENTRATION NEAR	TOTAL DECENTRATION	
					☐ SPHERE SURFACE ☐ SINGLE VISION ☐ BIFOCAL
R					☐ TRIFOCAL % INT
L					☐ TINT ☐ OTHER

SPECIAL LENSES OR FRAME *(Details and/or circumstances necessitating prior approval under current instructions and/or regulations. Only identical duplicate prescriptions and components should be ordered on the same DD Form 771.)*

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF APPROVING AUTHORITY

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF PRESCRIBING OFFICER

DISTRIBUTION OF COPIES	CLINIC Originating Prescription - Removes Copy 3 for insertion in patient's Health Record (DD Form 722). Sends Copies 1 and 2 to designated optical laboratory. LABORATORY-Retains Copy 1 for file. Returns Copy 2 with completed spectacles.

DD FORM 1 SEP 66 771 REPLACES EDITION OF 1 DEC. 64, WHICH MAY BE USED.

PROBLEM NO. 6

EYEWEAR PRESCRIPTION	DATE	ORDER NUMBER
TO: *(Optical Laboratory, including ZIP Code)*	FROM: *(Station & Location, including ZIP Code)*	
NAME *(Last, first, middle initial)* GRADE AND SERVICE NUMBER/SOCIAL SECURITY ACCOUNT NO.		AGE
UNIT AND ADDRESS		

☐ ACTIVE DUTY ☐ RETIRED ☐ OTHER *(Specify)*

☐ USA ☐ USN ☐ USAF ☐ USPHS ☐ USCG ☐ OTHER *(Specify)*

PRESCRIPTION

SPECTACLES: ☐ MALE ☐ FEMALE AVIATION SPECTACLES ☐ N-15 ☐ COATED ☐ CLEAR

OTHER: ☐ REPAIR ☐ PROTECTIVE MASK INSERT *(Specify type and position)*

INTERPUPILLARY DISTANCE DIS / NEAR	EYE SIZE	BRIDGE SIZE	TEMPLE LENGTH AND STYLE	NUMBER PAIR(S)	CASE

SINGLE VISION

	SPHERE	CYLINDER	AXIS	DECENTRATION IN/OUT	PRISM	BASE	FOR LABORATORY USE ONLY
R							☐ STANDARD ☐ NONSTANDARD
L							☐ FINISHED STOCK ☐ CYLINDER SURFACE

MULTIVISION

	ADD FOR NEAR	MULTIFOCAL INSTRUCTIONS SEGMENT HT	MULTIFOCAL INSTRUCTIONS DECENTRATION NEAR	TOTAL DECENTRATION	
					☐ SPHERE SURFACE ☐ SINGLE VISION ☐ BIFOCAL
R					☐ TRIFOCAL % INT
L					☐ TINT ☐ OTHER

SPECIAL LENSES OR FRAME *(Details and/or circumstances necessitating prior approval under current instructions and/or regulations. Only identical duplicate prescriptions and components should be ordered on the same DD Form 771.)*

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF APPROVING AUTHORITY

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF PRESCRIBING OFFICER

DISTRIBUTION OF COPIES	CLINIC Originating Prescription - Removes Copy 3 for insertion in patient's Health Record (DD Form 722). Sends Copies 1 and 2 to designated optical laboratory. LABORATORY-Retains Copy 1 for file. Returns Copy 2 with completed spectacles.

DD FORM 1 SEP 66 771 REPLACES EDITION OF 1 DEC. 64, WHICH MAY BE USED.

Figure 2-26
1-36

PROBLEM NO. 6

EYEWEAR PRESCRIPTION	DATE	ORDER NUMBER
TO *(Optical Laboratory, including ZIP Code)*	FROM *(Station & Location, including ZIP Code)*	
NAME *(Last, first, middle initial)* GRADE AND SERVICE NUMBER/SOCIAL SECURITY ACCOUNT NO		AGE
UNIT AND ADDRESS		
☐ ACTIVE DUTY ☐ RETIRED ☐ OTHER *(Specify)*	☐ USA ☐ USN ☐ USAF ☐ USPHS ☐ USCG ☐ OTHER *(Specify)*	

PRESCRIPTION

SPECTACLES ☐ MALE ☐ FEMALE | AVIATION SPECTACLES ☐ N 15 ☐ COATED ☐ CLEAR

OTHER ☐ REPAIR ☐ PROTECTIVE MASK INSERT *(Specify type and position)*

INTERPUPILLARY DISTANCE DIS / NEAR	EYE SIZE	BRIDGE SIZE	TEMPLE LENGTH AND STYLE	NUMBER PAIR(S)	CASE

SINGLE VISION

	SPHERE	CYLINDER	AXIS	DECENTRATION IN/OUT	PRISM	BASE
R						
L						

MULTIVISION

	ADD FOR NEAR	MULTIFOCAL INSTRUCTIONS		TOTAL DECENTRATION
		SEGMENT HT	DECENTRATION NEAR	
R				
L				

FOR LABORATORY USE ONLY

☐ STANDARD
☐ NONSTANDARD
☐ FINISHED STOCK
☐ CYLINDER SURFACE
☐ SPHERE SURFACE
☐ SINGLE VISION
☐ BIFOCAL
☐ TRIFOCAL % INT
☐ TINT
☐ OTHER

SPECIAL LENSES OR FRAME *(Details and/or circumstances necessitating prior approval under current instructions and/or regulations. Only identical duplicate prescriptions and components should be ordered on the same DD Form 771.)*

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF APPROVING AUTHORITY

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF PRESCRIBING OFFICER

DISTRIBUTION OF COPIES	*CLINIC Originating Prescription* - Removes Copy 3 for insertion in patient's Health Record (DD Form 722). Sends Copies 1 and 2 to designated optical laboratory. *LABORATORY* - Retains Copy 1 for file. Returns Copy 2 with completed spectacles.

DD FORM 1 SEP 66 771

PROBLEM NO. 7

EYEWEAR PRESCRIPTION	DATE	ORDER NUMBER
TO *(Optical Laboratory, including ZIP Code)*	FROM *(Station & Location, including ZIP Code)*	
NAME *(Last, first, middle initial)* GRADE AND SERVICE NUMBER/SOCIAL SECURITY ACCOUNT NO		AGE
UNIT AND ADDRESS		
☐ ACTIVE DUTY ☐ RETIRED ☐ OTHER *(Specify)*	☐ USA ☐ USN ☐ USAF ☐ USPHS ☐ USCG ☐ OTHER *(Specify)*	

PRESCRIPTION

SPECTACLES: ☐ MALE ☐ FEMALE | AVIATION SPECTACLES ☐ N 15 ☐ COATED ☐ CLEAR

OTHER ☐ REPAIR ☐ PROTECTIVE MASK INSERT *(Specify type and position)*

INTERPUPILLARY DISTANCE DIS / NEAR	EYE SIZE	BRIDGE SIZE	TEMPLE LENGTH AND STYLE	NUMBER PAIR(S)	CASE

SINGLE VISION

	SPHERE	CYLINDER	AXIS	DECENTRATION IN/OUT	PRISM	BASE
R						
L						

MULTIVISION

	ADD FOR NEAR	MULTIFOCAL INSTRUCTIONS		TOTAL DECENTRATION
		SEGMENT HT	DECENTRATION NEAR	
R				
L				

FOR LABORATORY USE ONLY

☐ STANDARD
☐ NONSTANDARD
☐ FINISHED STOCK
☐ CYLINDER SURFACE
☐ SPHERE SURFACE
☐ SINGLE VISION
☐ BIFOCAL
☐ TRIFOCAL % INT
☐ TINT
☐ OTHER

SPECIAL LENSES OR FRAME *(Details and/or circumstances necessitating prior approval under current instructions and/or regulations. Only identical duplicate prescriptions and components should be ordered on the same DD Form 771.)*

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF APPROVING AUTHORITY

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF PRESCRIBING OFFICER

DISTRIBUTION OF COPIES	*CLINIC Originating Prescription* - Removes Copy 3 for insertion in patient's Health Record (DD Form 722). Sends Copies 1 and 2 to designated optical laboratory. *LABORATORY* - Retains Copy 1 for file. Returns Copy 2 with completed spectacles.

DD FORM 1 SEP 66 771

EYEWEAR PRESCRIPTION

DATE

ORDER NUMBER

TO: (Optical Laboratory, including ZIP Code)

FROM: (Station & Location, including ZIP Code)

NAME (Last, first, middle initial) GRADE AND SERVICE NUMBER/SOCIAL SECURITY ACCOUNT NO

AGE

UNIT AND ADDRESS

☐ ACTIVE DUTY ☐ RETIRED ☐ OTHER (Specify)

☐ USA ☐ USN ☐ USAF ☐ USPHS ☐ USCG ☐ OTHER (Specify)

PRESCRIPTION

SPECTACLES: ☐ MALE ☐ FEMALE AVIATION SPECTACLES ☐ N 15 ☐ COATED ☐ CLEAR

OTHER ☐ REPAIR ☐ PROTECTIVE MASK INSERT (Specify type and position)

INTERPUPILLARY DISTANCE DIS / NEAR	EYE SIZE	BRIDGE SIZE	TEMPLE LENGTH AND STYLE	NUMBER PAIR(S)	CASE

SINGLE VISION

	SPHERE	CYLINDER	AXIS	DECENTRATION IN/OUT	PRISM	BASE	FOR LABORATORY USE ONLY
R							☐ STANDARD ☐ NONSTANDARD
L							☐ FINISHED STOCK ☐ CYLINDER SURFACE
	MULTIVISION						☐ SPHERE SURFACE
	ADD FOR NEAR	MULTIFOCAL INSTRUCTIONS SEGMENT HT		DECENTRATION NEAR	TOTAL DECENTRATION		☐ SINGLE VISION ☐ BIFOCAL
R							☐ TRIFOCAL % INT ☐ TINT
L							☐ OTHER

SPECIAL LENSES OR FRAME (Details and/or circumstances necessitating prior approval under current instructions and/or regulations. Only identical duplicate prescriptions and components should be ordered on the same DD Form 771.)

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF APPROVING AUTHORITY

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF PRESCRIBING OFFICER

DISTRIBUTION OF COPIES	CLINIC Originating Prescription - Removes Copy 3 for insertion in patient's Health Record (DD Form 722). Sends Copies 1 and 2 to designated optical laboratory. LABORATORY - Retains Copy 1 for file. Returns Copy 2 with completed spectacles.

DD FORM 1 SEP 68 771

EYEWEAR PRESCRIPTION

DATE

ORDER NUMBER

TO: (Optical Laboratory, including ZIP Code)

FROM: (Station & Location, including ZIP Code)

NAME (Last, first, middle initial) GRADE AND SERVICE NUMBER/SOCIAL SECURITY ACCOUNT NO

AGE

UNIT AND ADDRESS

☐ ACTIVE DUTY ☐ RETIRED ☐ OTHER (Specify)

☐ USA ☐ USN ☐ USAF ☐ USPHS ☐ USCG ☐ OTHER (Specify)

PRESCRIPTION

SPECTACLES: ☐ MALE ☐ FEMALE AVIATION SPECTACLES ☐ N 15 ☐ COATED ☐ CLEAR

OTHER ☐ REPAIR ☐ PROTECTIVE MASK INSERT (Specify type and position)

INTERPUPILLARY DISTANCE DIS / NEAR	EYE SIZE	BRIDGE SIZE	TEMPLE LENGTH AND STYLE	NUMBER PAIR(S)	CASE

SINGLE VISION

	SPHERE	CYLINDER	AXIS	DECENTRATION IN/OUT	PRISM	BASE	FOR LABORATORY USE ONLY
R							☐ STANDARD ☐ NONSTANDARD
L							☐ FINISHED STOCK ☐ CYLINDER SURFACE
	MULTIVISION						☐ SPHERE SURFACE
	ADD FOR NEAR	MULTIFOCAL INSTRUCTIONS SEGMENT HT		DECENTRATION NEAR	TOTAL DECENTRATION		☐ SINGLE VISION ☐ BIFOCAL
R							☐ TRIFOCAL % INT ☐ TINT
L							☐ OTHER

SPECIAL LENSES OR FRAME (Details and/or circumstances necessitating prior approval under current instructions and/or regulations. Only identical duplicate prescriptions and components should be ordered on the same DD Form 771.)

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF APPROVING AUTHORITY

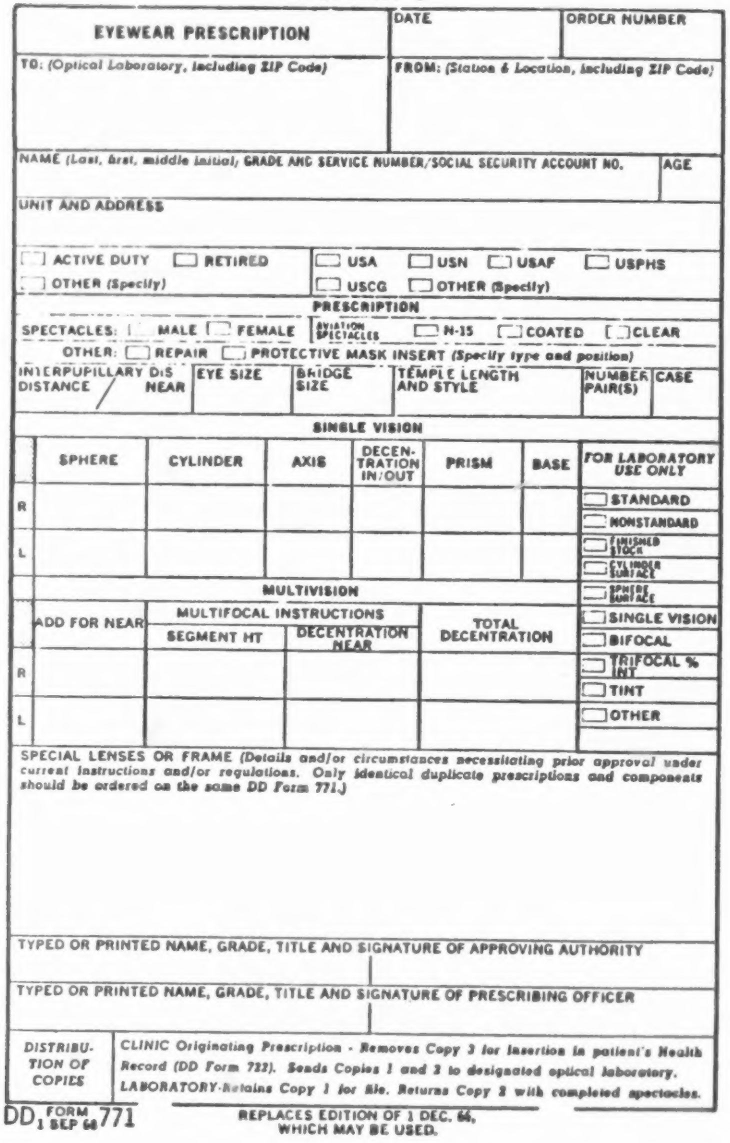
TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF PRESCRIBING OFFICER

DISTRIBUTION OF COPIES	CLINIC Originating Prescription - Removes Copy 3 for insertion in patient's Health Record (DD Form 722). Sends Copies 1 and 2 to designated optical laboratory. LABORATORY - Retains Copy 1 for file. Returns Copy 2 with completed spectacles.

DD FORM 1 SEP 68 771

Figure 2-27
1-34

PROBLEM NO. 8



EYEWEAR PRESCRIPTION	DATE	ORDER NUMBER
TO: *(Optical Laboratory, including ZIP Code)*	FROM: *(Station & Location, including ZIP Code)*	
NAME *(Last, first, middle initial)* GRADE AND SERVICE NUMBER/SOCIAL SECURITY ACCOUNT NO.	AGE	

UNIT AND ADDRESS

☐ ACTIVE DUTY ☐ RETIRED ☐ OTHER *(Specify)* | ☐ USA ☐ USN ☐ USAF ☐ USPHS ☐ USCG ☐ OTHER *(Specify)*

PRESCRIPTION

SPECTACLES: ☐ MALE ☐ FEMALE | AVIATION SPECTACLES ☐ N-15 ☐ COATED ☐ CLEAR

OTHER: ☐ REPAIR ☐ PROTECTIVE MASK INSERT *(Specify type and position)*

INTERPUPILLARY DISTANCE / NEAR	EYE SIZE	BRIDGE SIZE	TEMPLE LENGTH AND STYLE	NUMBER PAIR(S)	CASE

SINGLE VISION

	SPHERE	CYLINDER	AXIS	DECENTRATION IN/OUT	PRISM	BASE	FOR LABORATORY USE ONLY
R							☐ STANDARD ☐ NONSTANDARD
L							☐ FINISHED STOCK ☐ CYLINDER SURFACE

MULTIVISION

	ADD FOR NEAR	MULTIFOCAL INSTRUCTIONS		TOTAL DECENTRATION	
		SEGMENT HT	DECENTRATION NEAR		☐ SPHERE SURFACE ☐ SINGLE VISION ☐ BIFOCAL
R					☐ TRIFOCAL % INT ☐ TINT
L					☐ OTHER

SPECIAL LENSES OR FRAME *(Details and/or circumstances necessitating prior approval under current instructions and/or regulations. Only identical duplicate prescriptions and components should be ordered on the same DD Form 771.)*

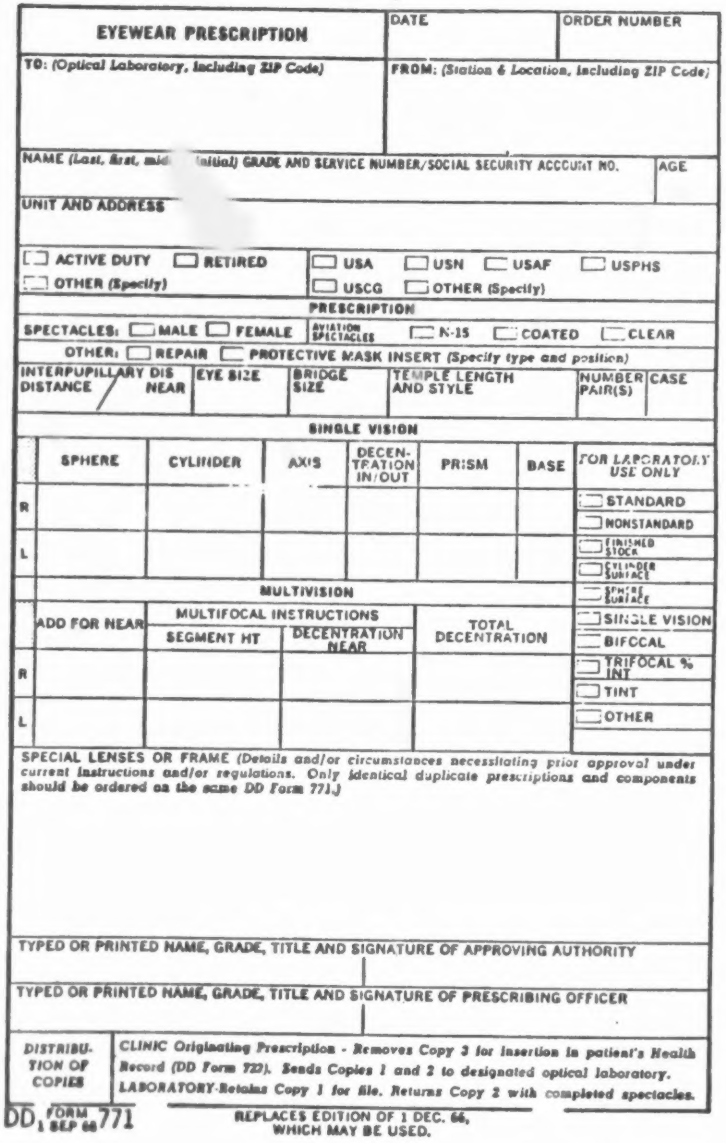
TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF APPROVING AUTHORITY

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF PRESCRIBING OFFICER

DISTRIBUTION OF COPIES	CLINIC Originating Prescription - Removes Copy 3 for insertion in patient's Health Record (DD Form 722). Sends Copies 1 and 2 to designated optical laboratory. LABORATORY-Retains Copy 1 for file. Returns Copy 2 with completed spectacles.

DD FORM 1 SEP 68 771 REPLACES EDITION OF 1 DEC. 66, WHICH MAY BE USED.

PROBLEM NO. 9



EYEWEAR PRESCRIPTION	DATE	ORDER NUMBER
TO: *(Optical Laboratory, including ZIP Code)*	FROM: *(Station & Location, including ZIP Code)*	
NAME *(Last, first, middle initial)* GRADE AND SERVICE NUMBER/SOCIAL SECURITY ACCOUNT NO.	AGE	

UNIT AND ADDRESS

☐ ACTIVE DUTY ☐ RETIRED ☐ OTHER *(Specify)* | ☐ USA ☐ USN ☐ USAF ☐ USPHS ☐ USCG ☐ OTHER *(Specify)*

PRESCRIPTION

SPECTACLES: ☐ MALE ☐ FEMALE | AVIATION SPECTACLES ☐ N-15 ☐ COATED ☐ CLEAR

OTHER: ☐ REPAIR ☐ PROTECTIVE MASK INSERT *(Specify type and position)*

INTERPUPILLARY DISTANCE / NEAR	EYE SIZE	BRIDGE SIZE	TEMPLE LENGTH AND STYLE	NUMBER PAIR(S)	CASE

SINGLE VISION

	SPHERE	CYLINDER	AXIS	DECENTRATION IN/OUT	PRISM	BASE	FOR LABORATORY USE ONLY
R							☐ STANDARD ☐ NONSTANDARD
L							☐ FINISHED STOCK ☐ CYLINDER SURFACE

MULTIVISION

	ADD FOR NEAR	MULTIFOCAL INSTRUCTIONS		TOTAL DECENTRATION	
		SEGMENT HT	DECENTRATION NEAR		☐ SPHERE SURFACE ☐ SINGLE VISION ☐ BIFOCAL
R					☐ TRIFOCAL % INT ☐ TINT
L					☐ OTHER

SPECIAL LENSES OR FRAME *(Details and/or circumstances necessitating prior approval under current instructions and/or regulations. Only identical duplicate prescriptions and components should be ordered on the same DD Form 771.)*

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF APPROVING AUTHORITY

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF PRESCRIBING OFFICER

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Figure 2-28

1-38

PROBLEM NO.10

EYEWEAR PRESCRIPTION

DATE

ORDER NUMBER

TO: *(Optical Laboratory, Including ZIP Code)*

FROM: *(Station & Location, Including ZIP Code)*

NAME *(Last, first, middle initial)* GRADE AND SERVICE NUMBER/SOCIAL SECURITY ACCOUNT NO.

AGE

UNIT AND ADDRESS

☐ ACTIVE DUTY ☐ RETIRED ☐ OTHER *(Specify)*

☐ USA ☐ USN ☐ USAF ☐ USPHS ☐ USCG ☐ OTHER *(Specify)*

PRESCRIPTION

SPECTACLES: ☐ MALE ☐ FEMALE AVIATION SPECTACLES ☐ N-15 ☐ COATED ☐ CLEAR

OTHER: ☐ REPAIR ☐ PROTECTIVE MASK INSERT *(Specify type and position)*

INTERPUPILLARY DISTANCE DIS / NEAR	EYE SIZE	BRIDGE SIZE	TEMPLE LENGTH AND STYLE	NUMBER PAIR(S)	CASE

SINGLE VISION

	SPHERE	CYLINDER	AXIS	DECENTRATION IN/OUT	PRISM	BASE
R						
L						

FOR LABORATORY USE ONLY

☐ STANDARD
☐ NONSTANDARD
☐ FINISHED STOCK
☐ CYLINDER SURFACE
☐ SPHERE SURFACE
☐ SINGLE VISION
☐ BIFOCAL
☐ TRIFOCAL % INT
☐ TINT
☐ OTHER

MULTIVISION

	ADD FOR NEAR	MULTIFOCAL INSTRUCTIONS		TOTAL DECENTRATION
		SEGMENT HT	DECENTRATION NEAR	
R				
L				

SPECIAL LENSES OR FRAME *(Details and/or circumstances necessitating prior approval under current instructions and/or regulations. Only identical duplicate prescriptions and components should be ordered on the same DD Form 771.)*

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF APPROVING AUTHORITY

TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF PRESCRIBING OFFICER

DISTRIBUTION OF COPIES	*CLINIC Originating Prescription - Removes Copy 3 for insertion in patient's Health Record (DD Form 722). Sends Copies 1 and 2 to designated optical laboratory. LABORATORY-Retains Copy 1 for file. Returns Copy 2 with completed spectacles.*

DD FORM 1 SEP 68 771

REPLACES EDITION OF 1 DEC. 66, WHICH MAY BE USED.

PROBLEM NO. 10

EYEWEAR PRESCRIPTION
DATE
ORDER NUMBER
TO: (Optical Laboratory, Including ZIP Code)
FROM: (Station & Location, Including ZIP Code)
NAME (Last, first, middle initial) GRADE AND SERVICE NUMBER/SOCIAL SECURITY ACCOUNT NO.
AGE
UNIT AND ADDRESS
☐ ACTIVE DUTY ☐ RETIRED ☐ OTHER (Specify)
☐ USA ☐ USN ☐ USAF ☐ USPHS ☐ USCG ☐ OTHER (Specify)
PRESCRIPTION
SPECTACLES: ☐ MALE ☐ FEMALE AVIATION SPECTACLES ☐ N-15 ☐ COATED ☐ CLEAR
OTHER: ☐ REPAIR ☐ PROTECTIVE MASK INSERT (Specify type and position)
INTERPUPILLARY DISTANCE DIS / NEAR | EYE SIZE | BRIDGE SIZE | TEMPLE LENGTH AND STYLE | NUMBER PAIR(S) | CASE
SINGLE VISION
SPHERE | CYLINDER | AXIS | DECENTRATION IN/OUT | PRISM | BASE
R
L
FOR LABORATORY USE ONLY
☐ STANDARD ☐ NONSTANDARD ☐ FINISHED STOCK ☐ CYLINDER SURFACE ☐ SPHERE SURFACE ☐ SINGLE VISION ☐ BIFOCAL ☐ TRIFOCAL % INT ☐ TINT ☐ OTHER
MULTIVISION
ADD FOR NEAR | MULTIFOCAL INSTRUCTIONS: SEGMENT HT | DECENTRATION NEAR | TOTAL DECENTRATION
R
L
SPECIAL LENSES OR FRAME (Details and/or circumstances necessitating prior approval under current instructions and/or regulations. Only identical duplicate prescriptions and components should be ordered on the same DD Form 771.)
TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF APPROVING AUTHORITY
TYPED OR PRINTED NAME, GRADE, TITLE AND SIGNATURE OF PRESCRIBING OFFICER
DISTRIBUTION OF COPIES | CLINIC Originating Prescription - Removes Copy 3 for insertion in patient's Health Record (DD Form 722). Sends Copies 1 and 2 to designated optical laboratory. LABORATORY-Retains Copy 1 for file. Returns Copy 2 with completed spectacles.
DD FORM 1 SEP 68 771
REPLACES EDITION OF 1 DEC. 66, WHICH MAY BE USED.

Figure 2-29

THE PRESCRIPTION ORDER LOGBOOK

Most AF optometry clinics process several hundred prescriptions weekly. It is very important to keep a record indicating what glasses are on order and where they are. The prescription order logbook maintains these records.

The prescription order logbook is a consolidated record of spectacle orders sent from the clinic to the optical lab. This logbook is usually written in a ledger and is intended as a supplement to the suspense or working file of DD 771s. The format of the logbook may vary from base to base, the example in Figure 2-30 below is representative of most systems.

Order Number	Date Ordered	Patient's Name, Address & SSAN	Rank	Sq	Duty Phone	Type Specs	Notification Date(s)	Pick-up Date	PT's Initials

Figure 2-30

1. Order Number: This is the same number that is recorded in the upper right hand corner of the DD 771. It consists of the serial number assigned to the order, a hyphen and the last two digits indicating the fiscal year. Each prescription form must have a different number, even though the different Rxs may be issued to the same patient. Do not forget to change the fiscal year date and start over numerically.

2. Date Ordered: This date should coincide with the date on the DD 771. Remember, spectacle orders should be mailed to the fabricating lab daily.

3. Patient's Name, Rank and Address: This information is necessary to correctly identify and notify the patient when his/her glasses have arrived. Some patients are difficult to locate if they have a PCS, retirement or discharge. Frequently, the Base Locator is unable to provide you with a satisfactory forwarding address. However, experience has shown that people almost invariably provide their local mailman or post office a forwarding address as soon as they are established. Then you can either obtain the new address by telephone, or if more convenient, simply mail the spectacles to the old address and the local post office will forward them. This procedure prevents your clinic from accumulating a lot of unclaimed spectacles.

4. Squadron and Duty Phone: This information will also help you in your notification procedures.

5. Types of Spectacles: Record this information so that you can identify multiple prescription orders and identify the lab to which the orders were mailed.

6. Notification Date(s): This information will give you a record of when you notified the patient that the glasses have arrived. Unclaimed spectacles may be used in stock or returned to the fabricating laboratory with the DD Form 771 and a note explaining why you have returned them.

7. Pickup Date and Patient's Initials: Fill in the date the spectacles are issued to the patient and have him initial the logbook. Copy three of the DD 771 must be filed in the patient's medical records.

8. Aviation spectacles must be kept in your prescription order logbook or a separate logbook to include the patient's name, military address and SSAN. Leave an extra space for the "Eligibility Verified" signatures.

As you were told earlier in this block, there are times when the patient must sign the logbook. That time is when an officer or enlistee wishes to order flight frame spectacles. Remember "Eligibility verified by officer's or enlistee's signature". These signatures go in the logbook.

NOTIFICATION OF SPECTACLE ARRIVAL

There are many ways of notifying patients that their spectacles have arrived. Some are better than others. The most ineffective method is placing the spectacles in distribution. Very often the patient never receives them. A second method is to call each patient on the phone. This is not only time consuming, but in many cases the patient never receives the message.

The recommended method of notification is the post card system. When a patient visits the eye clinic, have the patient self-address a card and retain the card on file until the spectacles arrive from the optical lab. Once you have received the spectacles and verified them for accuracy, the postcard notice can be mailed to the patient. If the patient does not pick up the spectacles within a reasonable period of time, you can send out a second postcard reminder.

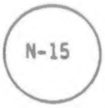
EXERCISE II-1g

INSTRUCTIONS

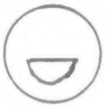
Fill in the blanks.

1. The standard military issue bifocal is called ______________________ or _________________ _________________. This style bifocal is ___________________ onto the front surface.
2. The executive style bifocal gains additional power through the reading segment because the _________________ __________________________ are steeper than the distance portion.
3. The term "N-15" means ____ ____.
4. Most trifocal intermediate segments are ______________________________% of the bifocal segment power.
5. Must you justify special purpose lenses? ________
6. Can you be issued special purpose lenses for personal preference? __________
7. Which of the following lenses would not be considered a special purpose lens?

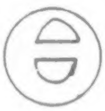
a.



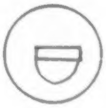
b.



c.



d.



EXERCISE II-1h

INSTRUCTIONS

Notifying patients that spectacles have arrived. Match Column A with Column B

	COLUMN A		COLUMN B
________	1. Mail	________	a. Most time consuming
________	2. Telephone	________	b. Least effective
________	3. Distribution	________	c. Recommended

Part III Complete the following statements in the spaces provided:

1. On 30 Sep 1983, you mail the last of your daily prescription orders to the Optical Lab. The last DD Form 771 you completed was the 5999th prescription in that fiscal year.

a. What order number did the 5999th DD Form 771 have? ________

b. What order number will the initial DD Form 771 have on the next day? ________

2. What is a Prescription Order Logbook? ________

____

____

3. When are patient signatures and special entries required in the logbook? ________

____

4. When do you start the order numbers over again? ________

II-1c. Given ANSI Z80.1 standards and twelve (12) pair of spectacles with their corresponding 771s, verify that the spectacles meet the standards with no more that two (2) instructor assists per box.

ANSI Z80.1 STANDARDS

There are five Army and seven Navy optical laboratories located in the United States to service all CONUS Army, Navy and Air Force eye clinics. Each laboratory processes thousands of spectacle requisitions every day. The largest of these laboratories is located at the Fitzsimons Army Medical Center, Aurora, Colorado. During fiscal year 1981, this laboratory alone fabricated 322,709 pairs of spectacles. This statistic is even more remarkable, when it is considered in terms of 665,418 lenses individually fabricated to meet various unique specifications.

When an Air Force eye clinic receives spectacles from the military optical lab, the DD Form 771 accompanying each pair of spectacles is usually stamped, "Inspected by ________," along with the date of the inspection. One might conclude that no further inspection of the spectacles is required. But exactly the opposite is true. Because of all the specifications to be verified with each pair, and because of the great number of spectacles to be inspected daily, certain Rx specifications may be overlooked at the final checkout point. This makes it necessary for you to verify the spectacles upon receipt and before dispensing.

To some technicians, it may be very tempting and much easier to file newly arrived spectacles in the ready-bin for pickup and "hope" that all is well. After all, the patient will be sure to complain if the prescription does not seem correct. This is unfair to your patients and a poor way to do your job, it is an instult to your doctor who spent his precious time examining the patient, and lastly, it will give your clinic a bad reputation.

Accepted Tolerances

In order to establish a logical routine for spectacle verification, both the lab and the eye clinic must follow common guidelines or standards. The standards will be summarized in this SW. These standards are dictated by the American National Standards Institute and are called ANSI-Z80.1 Standards 1979. Because we don't use lab verification instruments, the following standards have been modified to fit clinics needs:

1. Power-Sphere	Plano to 6.50 D Above 6.50 D	±0.12 D ±0.25 D
2. Power-Cylinder	Plano to 4.50 D Above 4.50 D	±0.12 D ±0.25 D
3. Cylinder Axes	0.12 D cyl to 0.37 D 0.50 D cyl to 0.75 D 0.87 D cyl to 1.50 D Above 1.50 D cyl	± 007° ± 005° ± 003° ± 002°
4. Bifocal Add Power (distance powers)	Plano to 8.00 D Above 8.00 D	± 0.12 D ± 0.25 D

5. Prism

a. Horizontal (base in or out)

(1) Total of both lenses 2/3 D (0.66 D)
(2) In high power lenses the PD must be within 2.5mm of that prescribed.

b. Vertical (base up or down)

(1) Total of both lenses 1/3 D (0.33 D)
(2) No more than 1mm difference in vertical levels of optical centers on high power lenses

6. Segment position

a. Vertical measurement should be within 1mm of that specified on Rx.

b. Horizontal measurement of optical centers should be within 2.5mm of the specified PD.

7. Miscellaneous lens requirements:

a. Surface: There should be no pits, scratches, gray areas, or water spots. Minor hairline scratches are permitted.

b. Internal: There should be no bubbles or foreign material embedded in the lens.

c. Waves: There should be no waves producing distorted image quality during the lensomety inspection. tion.

d. Warpage: Within ± 1.00 D of the lens manufacturer's design specifications as measured with a lens clock. (No requirement for plastic lens mounted in metal frames.)

e. Thickness (1) Impact resistant lenses (Dress safety eyewear)

Optical center --------------------Not less than 2mm
Edge-------------------------------Not less than 1mm
Average between center and
thinnest edge----------------------Not less than 1.7mm

(2) Impact resistant lenses (Industrial safety eyewear):
Not less than 3mm at edge or center. (thinnest point)

8. Frame size: As specified.

Equipment and Procedures Required for Spectacle Verification

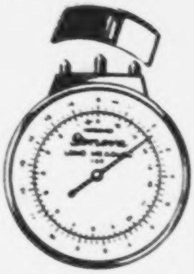
In nearly all of your work as an optometry technician, it seems that the simple millimeter ruler is indispensible. Spectacle verification is no exception. Other major items of equipment you will need are:

Measure Lens, Ophthalmic (Lens Clock) Figure 3-1

Lens, Measuring Instrument, Ophthalmic Figure 3-2

Gage, Thickness, Ophthalmic Lens - Figure 3-3

MEASURE, LENS, OPHTHALMIC

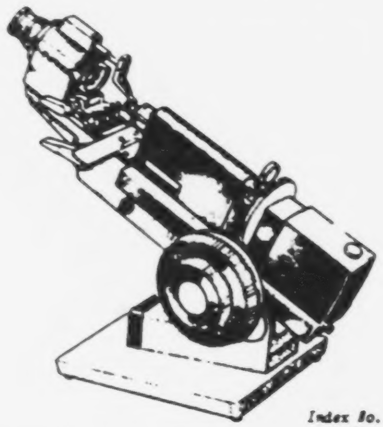


Lens clock. Graduated in 1/4 diopter steps to plus and minus 17.00 diopters.

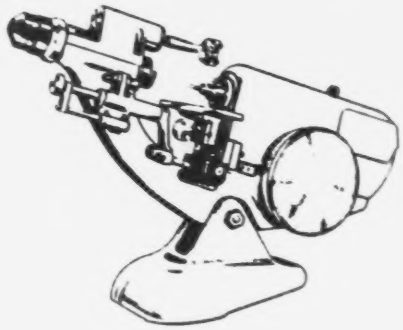
Action	Index No.	National Stock No.	Descriptive Data
—	17460	6540-00-261-7238	Geneva Improved

Figure 3-1

LENS MEASURING INSTRUMENT, OPHTHALMIC



Index No. 17425



Index No. 17430

With lamps, and prism measuring and marking device.

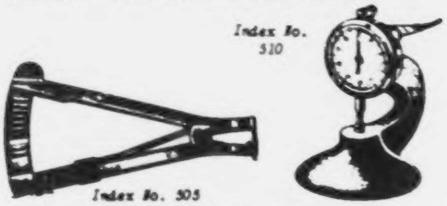
Index No. *17425*—15 watts. For replacement lensometer lamp, use Industry No. 15S11/87 (Clear) 125 volt, 15 watt, Bulb S-11, clear, intermediate screw base.

Index No. *17430*—25 watts. For replacement vertometer lamp, use Industry No. 25S11/5C (White Inside Coated) 115 volt, 25 watt, Bulb S-11, white inside coated, candelabra screw base.

Action	Index No.	National Stock No.	Descriptive Data
—	*17425*	6540-00-181-8037	115 volt, 60 Hz, AC
—	*17430*	6540-00-299-8134	115 volt, 60 Hz, AC

Figure 3-2

GAGE, THICKNESS, OPHTHALMIC LENS



Index No. 505—Hand type. Graduated from 0 to 13 mm in 0.1 mm intervals. With adjustable points and setscrew.

Index No. 510—Bench type. Graduated from 0 to 10 mm in 0.1 mm intervals. Mounted on a 3-1/2 in. dia base.

Action	Index No.	National Stock No.	Descriptive Data
—	505	6540-00-267-3369	—
—	510	6540-00-299-9548	Dial Indicating

Figure 3-3

Standards for impact resistant lenses permit a tolerance, or lab error, of ± 0.12 diopters in prescriptions up to 6.50 D. This is a liberal tolerance, and inspection of lens power should adhere to that standard. However, the power discrepancy should never exceed ± 0.25 D, even on lenses over 6.62 D, without a professional opinion as to whether a change in vertex distance through frame adjustment can make up the power differences. With most military spectacles, altering the vertex distance is difficult, unless the frame has been ordered with adjustable nose pads. By proper manipulation of the nose pad guard arms, the vertex distance of the lenses can be increased or decreased to improve the effective power of the lenses. Unless the lenses are over 4.00 D, very little effective power change is accomplished by altering the vertex distance.

Some power discrepancies are a result of the laboratory inadvertently mounting the lenses eye for eye reversing right and left lenses. The military S-10 lens shape is symmetrical and it is possible to remove the lenses and correctly remount them. After doing this, it's a good idea to spot the optical centers and make certain that the decentration is correct.

Cylinder axes. Routine inspection of newly received spectacles will turn up a certain percentage of discrepancies in cylinder axes. Many of these need not be returned to the lab for correction. For example, the standard on lenses permits an error of ± 7° with up to 0.37 D cylinder power, ± 5° error with cylinder powers from 0.50 D to 0.75 D, ± 3° error with cylinder powers from 0.87 D to 1.50 D, and ± 2° with cylinder powers of 1.62 D and up. In cases where the eye clinic receives a given cylinder prescription off axis perhaps three or four degrees beyond those acceptable tolerance points, it is frequently possible to correct the problem by simply softening the plastic frame rim with heat and then rotating the lens in the direction of the axis desired. For this purpose, a lens axis aligning plier is invaluable. In the case of the metal aircrew frame, a lens can be rotated slightly when the eyewire screw is loosened a few turns and then retightened to hold the lens in place. The lens should then be tested to make certain that is has not been rotated into a slanted position. There are, of course, limitations as to how far any given lens can be rotated within the configuration of the frame rim, but it makes sense to use this procedure first before declaring the lens "off axis" and shipping the spectacles back to the optical laboratory for correction.

Segment heights. As mentioned earlier the heights should be within 1 mm of what was ordered. The distance between optical centers of the segments should not exceed 2.5 mm difference from the near PD. This is a critical area of concern because the segments are usually stronger than the carrier lens, so the possibilities of unwanted prism is high and not easily corrected with frame adjustments.

Frames. Discrepancies in bridge or temple sizes can be corrected if spare frame parts are stocked in the eye clinic. However, when it is necessary to remount lenses into another frame, to obtain a wider or narrower bridge, be careful not to introduce an unacceptable amount of lateral prism as a result of altering the mechanical distance between optical centers. Generally speaking, if the lenses on both sides of the spectacles have less than 2.50 diopters of power along the horizontal axis, they can be remounted in a frame with a two millimeter wider or narrower bridge with no undesirable prismatic effect. If a four millimeter change in bridge size is necessary, the lenses should be no more than 1.25 diopters in power along the horizontal meridian to avoid excessive prismatic effect.

Exceptions to this general rule are possible, but the technicians should let the prescribing doctor make the decision. The standards permit as much as 1/3 (prism diopters) of unwanted horizontal prism in each lens or as much as 2/3 (0.66D) total imbalance. If the general rule is followed the prism tolerance will not be exceeded and there will be no problems with patient comfort. On the other hand, if the patient has a slight lateral muscle imbalance, either esophoria or exophoria, it is conceivable that an excess of unwanted horizontal prism might not be significant to the patient if the prism is in the proper direction and the discrepancy is only slightly beyond the standards. However, your doctor's judgement is necessary if the tolerance is going to be exceeded.

Yes, you get to use the lensometer again. You will first neutralize the prescription to make sure the sphere, cylinder, axis and add powers are within ANSI Standards.

While checking the Rx look for vertical and horizontal prism. How? Put the strongest lens in place and neutralize it, center the mires, then switch to the other lens. Are the mires still centered or are they above or below center? When above, it is base up prism and is indicated by the rings marked "1, 2, 3". Of course if the mires center in between the rings, you figure it as ½, 1½, or 2½. The same is true if the mires are below center, except it is called base down prism. Horizontal prism is easy. Center each lens separately and spot with the ink spotter. This shows the optical center of the lenses. Theoretically the measurement between the optical centers should be equal that of the patient's PD. When the difference is less than 2.5 mm it's considered within standards.

Using your PD rule next measure the segment heights to make sure they are as you ordered them. Almost done, examine lenses to make sure there aren't any scratches and then look at frame size. Is it what you ordered? Now you are finished.

EXERCISE II-1i

INSTRUCTIONS

Answer the following questions in the spaces provided.

1. How far off axis may the following impact resistant cylinders be and still be acceptable? (Give the range for each)

   a. + 2.00 D cx 090 ______________________________

   b. + 1.00 D cx 088 ______________________________

   c. + 0.50 D cx 180 ______________________________

   d. + 1.25 D cx 135 ______________________________

   e. - 0.75 D cx 175 ______________________________

   f. - 3.00 D cx 167 ______________________________

2. An Rx reads O.U. + 10.00 D sph. What range of power above or below+ 10.00 D would be acceptable if the lens was off-power somewhat?

   ____

3. What are the total limits of vertical and horizontal prism in a pair of spectacles?

   ____

4. Column 1 gives you a listing of spectacle lenses. Column 2 gives you the results of an inspection of each lens. In each example note the discrepancy, if any, and state whether or not the lens meets acceptable standards.

COLUMN 1	COLUMN 2
a. -2.00 D sph Impact resistant	a. -1.87 D sph Impact resistant
b. -4.00 D sph Plastic	b. -4.12 D sph Plastic
c. -2.50 D sph = -0.50 cx 150 Impact resistant	c. -2.62 D sph = + .62 cx 152 Impact resistant
d. -2.00 D sph = -0.25 cx 180	d. +2.00 D sph = -0.25 cx 005
e. -1.00 D sph	e. +1.12 D sph
f. +1.50 D sph	f. +1.50 D sph = 0.15 base in prism

5. What instrument could you use to verify a lens prescription is heat treated?

____

How does the laboratory notify you that a lens has been chemically treated?

____

II-1e Given an instructor selected patient, two (2) cellulose acetate frames, one (1) aircrew frame, and the necessary materials, adjust each frame to fit the patient with no more than one (1) instructor assist per frame.

FRAME ADJUSTING

Once in the field, it will not take long to learn that, next to the lens prescription itself, the most important aspect of patient happiness will depend on how well you adjusted the spectacle frame to the patient's face. A frame that is not properly aligned, that is too tight, or that is too loose, will annoy the patient. It is extremely important that you, the technician, provide each patient with the very best fit possible.

Fitting and Adjusting Tools and Equipment

1. Since military spectacle frames are made of a thermoplastic material, heat must be used to soften the frame for adjustment. This heat is supplied by the spectacle warmer, often called a sandbox or a saltbox (Figure 3-4) Also, remember to turn the frame warmer off each night to conserve energy.

WARMER, PLASTIC SPECTACLE FRAME

100 watts. Bath type; without glass beads. For glass beads, order 6640-00-299-9818.

Action	Index No.	National Stock No.	Descriptive Data
—	*17810*	6540-00-299-9590	115 volt, 60 Hz, AC

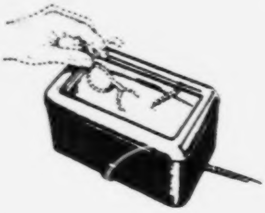
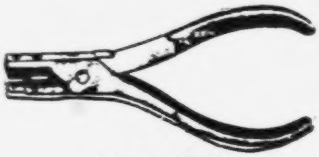


Figure 3-4

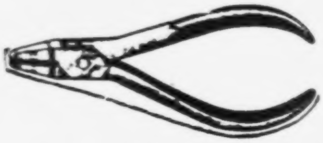
2. There are several types of pliers required for frame fitting and adjusting. The following figures show the most common types used in clinics today. These of course, are not all the pliers , but a good sampling.



Index No. 17540

Figure 3-5

a. Endpiece gripping plier. This plier is used to hold the hinge when angling a temple. It has a liner on one jaw which prevents damage to the front surface of the frame.



Index No. 17545

Figure 3-6

b. Fingerpiece plier. There are a variety of uses for this plier. It is particularly useful in anglinging temples on the metal aircrew frame, due to its parallel jaws.

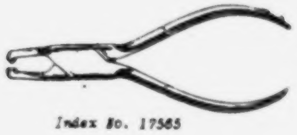


Figure 3-7

c. Screw and rivet peening pliers. The most frequent repair in the eye clinic is the replacement of lost temple screws. The screw and rivet pliers can be used to flatten the screw tip so that the screw cannot loosen and fall out. One jaw is hollow to prevent damage to the screw head.

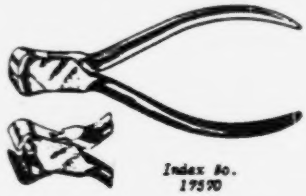


Figure 3-8

d. Screw cutting pliers. Its primary use is cutting long screws. It can also be used to cut the eyewire of plastic and metal frames when trying to salvage a lens from a frame with corroded or damaged screws. When cutting the eyewire, be extremely careful that you do not chip or crack the lens or get a chip in your eye.

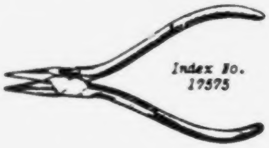


Figure 3-9

e. Snipe nose pliers. These have many uses. Its principal use is in the adjustment of the nosepad guard arms.

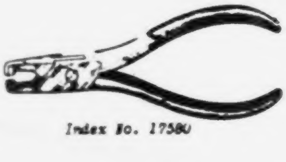


Figure 3-10

f. Temple angling pliers. These should be used in conjunction with the endpiece gripping pliers when adjusting the angle of the temple.

3. Miscellaneous tools and accessories:

a. Optician's screwdriver (Figure 3-11). The optician's screwdriver has a reversible blade suitable for large or small optical screwheads. The national Stock Number of this item is 5120-00-240-1544.

Figure 3-11

b. Screws. Replacement screws for the male and female plastic frames are available under NSN 5305-00-926-2976.

c. Files. A file is used to dress down plactic stock at the butt end of temples or frame fronts for a neater joint and to open temples to a wider angle when indicated. A file is also necessary to file the tips of burnished screws prior to removal with the screwdriver. Various types and styles of files are available. Bastard files are available under NSN 5110-00-204-2684 and 5110-00-234-6531. Another handy file set is listed under NSN 5110-00-204-2684.

Adjusting Procedures

In fitting spectacles to the patient, it is necessary to make various adjustments using the tools described above. The spectacles should be adjusted to make them as comfortable as possible while maintaining correct alignment. In some cases, the spectacles may be in perfect alignment with the patient's eyes, but still apear crooked on the patient's face. This is frequently due to one ear being slightly higher than the other, or to some irregularity of the patient's features. By proper adjustment and, in the case of multifocals, by proper ordering of segment heights, a satisfactory adjustment can be achieved.

Frames should be heated carefully in the sandbox, since the high temperatures may completely melt the frame. The frame should be moved around while heating to evenly distribute the heat and prevent pits from forming on the plastic surface. Repeated heating ages the frame and makes it brittle, so heat only that portion of the frame which is to be bent. Remember to let the frame cool before placing it on the patient. The frame can be cooled more rapidly by dipping it in cool water.

When adjusting spectacles with adjustable pads, the first step is to shape the guards so that the pads will lie evenly and loosely against the sides of the patient's nose. To make this adjustment, place the spectacles on the patient with the temples over the ears. Hold them by the rims with the temples spread as far apart as possible. Place the bridge of the glasses on the patient's nose in the position in which they will be worn and note any adjustments. Note also whether the temples should be spread, narrowed, or curved to conform with the sides of the patient's head. Shape the pads to conform with the patient's nose, making sure they do not squeeze the nose.

Next, place the spectacles on the patient with the temples over the ears. Turn the patient's head until you have a side view. Notice the position of the guards, the pantoscopic or retroscopic tilt, and the point where the temples fit the top of the ear. Pantoscopic tilt is when the bottom of the frame is closer to the face than the top and retroscopic tilt is when the top of the frame is closer. The proper angle is about 5-7° of pantoscopic tilt. After having noted what adjustments are necessary, remove the spectacles and shape the temples.

Shape the temples to conform to the contours of the patient's head. If the temples bind or touch the sides of the patient's head, file the butt of the temples until you have obtained the proper spread. Round the temples shafts with the thumb and the first two fingers of the hand until the temple shafts no longer press against the sides of the head.

Situated on the back of the ear, there is a flat space running from the top of the ear where the temple first touches to the high spot on the skull which lies halfway down the back of the ear. This flat part is usually at about a 70° angle. The temple should be shaped to lie flat between these two points. The high spot on the back of the ear is extremely sensitive and will become sore with very little pressure. Make a sharp bend in the temple here to distribute the pressure equally between the flat part of the ear and the curve below the high spot. The temple should be curved outward from the lob depression of the ear because this is another sensitive portion. Although a riding bow temple of the correct length will extend to the center of the lobe of the ear, the tip of the temple should always be shaped so that it will not press or dig into this portion.

Use the following method to shape a temple to conform with the ear. Grasp the shaft of the temple with the left hand to steady it. Place the forefinger of the right hand under the temple at the point where the temple first touches the ear. Place the third finger of the right hand about one-eighth inch down from the forefinger on the lower side of the temple and place the thumb between the fingers on the upper side. By exerting pressure with the thumb and two fingers of the right hand against the shaft and by holding the shaft steady with the left hand, the bend necessary at the top of the temple and the flat portion can be formed at the same time. Next, holding the temple in the same manner, make the temple bend at the high spot of the ear but do not flatten below the second bend. Now bend the tip of the temple outward. These bends should make the temple lie evenly along the back of the ear. If the temple does not lie in the proper place, it is necessary to rebend the temple until the proper distribution of pressure is obtained. After both temples have been shaped, replace the spectacles on the patient and note the guard adjustment, pantoscopic or retroscopic angle, and the parallelism of the lenses to the face, making readjustments if necessary.

The next step in adjusting is to determine if the spectacles are straight (correctly aligned) on the face. When deciding this, the eyebrows are a poor line to follow because of their width and the fact that they often vary in height one to the other. In adjusting bifocals or trifocals, mark the top of each segment and sight these marks with the line of the lower lids or the patient's pupils.

In adjusting spectacles to make the lenses lie straight on the face, bend the hinge endpiece to pantoscopic (downward) tilt on the low side, or bend the endpiece to give retroscopic (upward) tilt on the high side. It is necessary to use both the endpiece gripping plier and temple angling plier together to properly accomplish this. The bending of one eyepiece in retroscopic or pantoscopic direction does not raise or lower the spectacles as a whole on the face; the nose acts as a fulcrum and as one side is lowered the other is raised. Where both endpieces are bent, the effect is to increase the total pantoscopic or retroscopic angle as the case may be.

Next, note the position of the lenses, in relation to their distance from the eyes, particularly the lashes. The lenses should be set approximately 13-14mm from the cornea. The lenses should never touch the lashes. If the lenses are too far from the eyes, the easiest method of adjustment is to widen the spread of the nose pads. Should this widened spread cause the curl of the guard arm to come too close to the eye, the guard arms must then be shortened by manipulation. If the lenses touch the lashes, narrow the spread of the nose pads without pinching the nose; otherwise, the guard arms must be lengthened.

Notice the distance of each lens individually from each eye. If one lens is closer than the other it means that the temple tension is unequal. To make this adjustment, either file the butt of the temple that is too tight or shape the loose temple or its endpiece so that it exerts more pressure along the side of the head. Also, bend the tips of each temple in back of the ears to increase or lessen the tension as required. To be sure of equal temple tension, place the spectacles on the patient and, holding each endpiece by the tip of the first finger, pull the spectacles slightly forward from the nose and see if they fall back on the nose evenly.

Finally, check to see that each lens is equal distance from the nose. If not, refine the nosepad adjustment. Then make an overall determination that the fit is satisfactory.

SUMMARY

1. Ascertain that the glasses are in alignment and the lenses properly mounted.

2. For a frame with adjustable pads, adjust the pads so that they lie evenly or flat on the side of the nose and have the temples spread so they will not bind the sides of the head.

3. Shape the temples to conform to the back of the ear and bend the endpieces to the desired pantoscopic or retroscopic tilt. (Normally 5-7° of pantoscopic tilt).

4. Note the height or parallel position of each lens on the face, raising or lowering retroscopic or pantoscopic tilt of either temple as required.

5. Note the height of the glasses on the face.

6. Note the distance of the glasses from the cornea.

7. Note the distance of each lens from the nose.

8. Make a general check up of all previous adjustments.

Maladjustments and Remedies

Condition	Cause	Remedy
Pads dig into nose evenly.	Pads too tight	Widen distance between pads
	Temple tension to great behind ears.	Reduce tension.
	Pads too small for weight of glasses	Larger pads.
	Tender skin.	
Pads dig into nose unevenly.	Pads do not fit flat on nose	Correct pads to fit flat on nose.
	Temple angle greater on one side.	Correct temples.
Spectacles slide down on nose.	Distance between pads too great.	Bring pads closer together.
	Temple tension too weak or temples too long.	Replace with shorter temples or increase tension behind ears and on side of head.
Lashes touch the lenses.	Distance between pads too great.	Bring pads closer together.
	Temple tension too weak or temples too short.	Replace temples or adjust tension.
	Guard arms too short.	Lengthen guard arm.
Eyewires touch cheek.	Too much distance between pads.	Bring pads closer together.
	Pantoscopic temple angle too great	Reduce pantoscopic tilt.
	Lenses too large in vertical dimension.	Refit with smaller eye size.
Lenses touch brow.	Inset too far.	Lengthen guard arms.
	Resting point of nose too high	Lower spectacles by raising guard arms and pads.
	Too much retroscopic tilt.	Reduce retroscopic tilt.
One lens higher than the other.	Temples not adjusted to different ear heights	Correct temples either retroscopically or pantoscopically.
	One guard arm and pad lower than the other.	Adjust to balance.
	Deformed nose.	Compensate for difference with guard arm and pad.

Condition	Cause	Remedy
Bifocal segments cause blurred area.	Segments too high.	Tilt lenses more pantoscopically. Spread pads.
Lenses too far from eyes.	Pads improperly fitted.	Spread pads.
	Guard arms too long.	Shorten guard arms.
One lens out further than the other.	Temple angle uneven.	Correct temples in reference to angle.
	Uneven pressure.	Widen angle of temple on side of face which is larger.
Temples hurt behind ears.	Tension too great.	Loosen temple tension or get longer temples.
	Uneven pressure.	Bend temples to conform with shape of ear.
	Area of contact too small between temple and ear.	Use temple tubing to increase size of temple surface.
	Temple too short.	Get longer temples.
	Corroded or rough surface.	Replace temple.
	Temples ride too far out on top of ear and cartilage.	Bend tip of temple to correct.
	Temple tip rides too far out at the base of ear.	Bend tip of temple in.

II-1f. Given an aircrew frame, an S-10 frame, and the necessary materials, perform minor repair functions, with no more than one instructor assist per frame.

REPAIR

An industrious optometry specialist can repair or replace most parts of a spectacle frame. Only those repairs that can't be done in the clinic, such as a broken lens, should be sent to the lab for replacement.

EQUIPMENT AND PROCEDURES

1. FRAME WARMER.

WARMER, PLASTIC SPECTACLE FRAME
100 watts. Bath type; without glass beads. For glass beads, order 6640-00-299-9818.

Ac-tion	Index No.	National Stock No.	Description Data
—	17810	[illegible]	115 volt, 60 Hz, AC

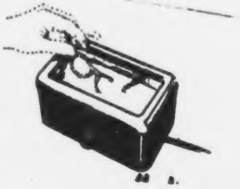


Figure 4-1

2. Punch, Opticians. This is a spring loaded instrument made of steel. It is used for riveting or peening operations in the assembly and repair of spectacles. It is listed as NSN6540-00-164-6419.

3. Anvil, optician's (Figure 4-2). This item is designed for use with the optician's punch described above.

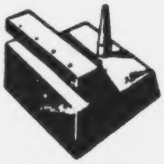


Figure 4-2

4. Lensometer

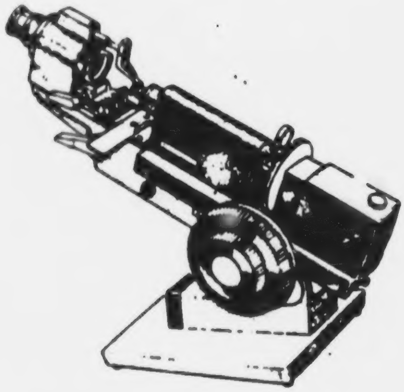


Figure 4-3

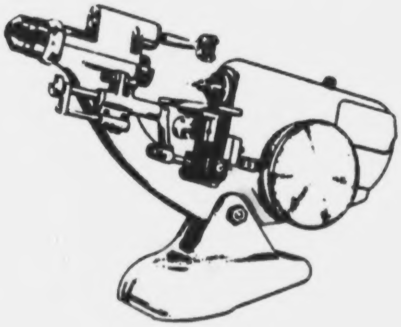


Figure 4-4

5. Lens axis aligning pliers. These pliers are used for the alignment of the cylinder axis of a lens once it is mounted into a plastic frame. After softening the frame rim in a frame warmer, the lens can easily be rotated on axis with axis aligning pliers. (Figure 4-5 and Figure 4-6)

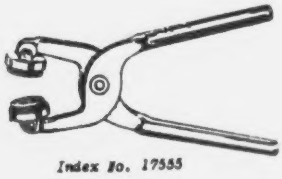


Figure 4-5

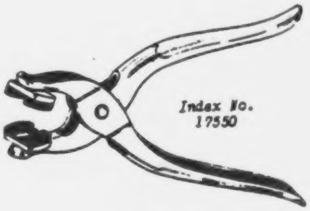


Figure 4-6

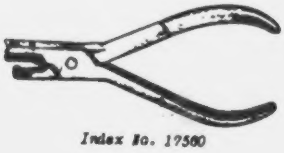


Figure 4-7

6. Rivet and shield burnishing plier. These pliers can be used to tighten loose hinges, as well as substitute for the endpiece gripping pliers. (Figure 4-7)

7. Container of cool water

8. Millimeter rule

9. File

10. Sandpaper

11. Screwdriver

12. Acetone

12. Crayon or india ink

MOUNTING AND POSITIONING SPECTACLE LENSES

Plastic Frames

At normal room temperatures,the plastic frame is not very pliable and may even be brittle if the frame is not new. Mounting or inserting lenses into plastic frames requires a method which will temporarily soften the material, so that is can be made pliable and expandable, followed by another procedure which will contract or shrink the plastic. Softening the plastic frames for pliability is best accomplished by dry heat such as we use with the traditional sandbox. Sand, salt, or glass beads may be used in the sandbox. There are also hot air blowers in the field designed for the same purpose. Cold water may be used to quickly cool a frame which has been heated in the sandbox or by hot air.

A good method to follow in mounting and positioning lenses into a spectacle frame follows:

1. Establish which lens is right and left. If the lenses are to be remounted from an old frame into a new frame, it is a good idea to mark an "R" on the right lens with a crayon or grease pencil. Remember that many lens shapes are symmetrical and you may not be able to tell which lens is right or left when they are out of a frame and side-byside on your workbench. A lensometer may also be used to establish the right and left lenses if you have a copy of the prescription. If both lenses are the same power on the lensometer but contain decentered optical centers, be sure you end up with the correct direction of decentration when the lenses are mounted. If the lenses have cylinder, use of the lensometer is a must to determine the axes.

2. Measure the lens diameter with a millimeter rule to determine the frame eye size required.

3. Select a frame in the correct size from your stock. If you find it easier to mount lenses with the temples off, you may want to remove the temples with your screwdriver before beginning the next step.

4. Heat the right rim of the frame first - always mount the right lens first. This habit will help prevent reversal of the lenses. When you insert the frame into the sandbox, don't go in vertically, instead keep the frame more or less horizontal to the table top. This will give a better distribution of heat to the frame and help prevent scorching. Move the rim around slowly and gently until you "feel" the frame rim soften from the heat. With practice you will learn to judge the correct amount of softening without touching the hot portion of the frame.

5. Once the plastic is softened, remove the frame from the sandbox and quickly insert the lens. Insert the lens from the front of the frame. You may find it easier to start the lens at the upper-nasal corner of the rim and work it in, around toward the temporal direction; or, you may want to start it at the upper-temporal corner and come around in the nasal direction. Be sure to fit the lens bevel into the frame progressively and then double check to make sure the lens is within the eyewire groove all the way around.

6. While the frame rim is still warm, place it in the lensometer to check the position of the cylinder axis (if any). If necessary, rotate the lens on axis with the axis aligning plier. Then double check with the lensometer.

7. Rewarm the rim very slightly and then plunge into cool water to contract the plastic firmly around the lens. Repeating this step several times tends to shrink the frame -- a procedure occasionally required if the lens is slightly smaller in diameter than it should be.

8. Repeat the above procedure for the left lens.

9. Remount the temples, and if necessary, true the frame up. Also, file-off any excess plastic stock on the endpieces or temple butts so that the temples are open an equal amount.

10. If you have scorched the frame slightly, sometimes you can save the frame. This can be done by dressing down the scorched area with fine sandpaper, then wipe acetone over the area with an applicator to restore the gloss. Repeat if necessary. When you use acetone, remember that it is a toxic substance. Frequent contact with the skin and inhalation of the fumes should be avoided. Keep away from children. Also, keep the bottle cap on tightly when not in use. Store properly in a cabinet. Keep away from open flames.

11. To remove a lens from the frame, warm the frame slightly and pop the lens out toward the front, starting with the nasal or temporal edge. Allow the frame to cool in air unless you wish to shrink it in water.

Metal Frames

Mounting lenses into a metal frame is a fairly simple operation. Loosen the eyewire screw with your optical screwdriver so that the eyewire is loose enough to accept the lens. Check to see that the lens is properly seated in the groove, and then tighten the screw. If the lens has a cylinder component, use the lensometer as before to check the axis, and finally retighten the screw. A lens can only be rotated a few degrees in a metal frame. Also with metal frames, it is sometimes wise to inspect the lens under a colmascope for excess strain.

EXERCISE II-1j

INSTRUCTIONS

Complete the following statements in the spaces provided.

1. If you were handed a pair of lenses to mount into an S-10 frame, state how you would determine the frame eyesize to select from stock.

2. If a pair of +8.00 D lenses are perfectly symmetrical, and if each lens has 3 mm of decentration but are not mounted in a frame so that you can tell right lens from left, state one method you would use to identify right and left lenses.

3. After you have identified the right and left lenses described in problem #2 above, describe how you would prevent another mix-up if you put them down to go to the telephone.

4. Why should you use a lensometer in conjuction with lens mounting?

5. When mounting lenses, why is it a good idea to develop a habit of mounting the right lens before you mount the left lens?

6. Why is it better to keep the frame more horizontal than vertical when warming it in the frame warmer?

7. List the precautions you should take concerning acetone.

8. If a lens is slightly small (in diameter) for the frame size for which it was shaped, explain what you would do.

II-1f. Given the necessary materials, duplicate eighteen (18) pairs of spectacles, with at least fifteen (15) correct.

DUPLICATION OF SPECTACLES

There will be times when patients come to you for help in getting another pair of glasses just like the ones they are using. Case in point, they might have broken their first pair and need a back-up pair. In most cases, the patients don't have their prescription with them, so what can you do for them? Duplicate the prescription using a lensometer.

Method Used:

1. With pen in hand begin the process by recording the date and order number in the appropriate boxes on a DD Form 771.

2. Fill in both the lab and clinic addresses.

3. Write down the patient's name, rank, ssan, address, and phone number.

4. Check the applicable boxes as to status, branch of service, type of spectacles, and other appropriate boxes.

5. Get your PD rule and measure the patient's PD.

6. Look at the frame and duplicate the eye size, bridge size, temple length and note how many pairs of spectacles are needed.

7. In the "Special Lenses or Frames" section, note the type of bifocals wanted if applicable. The appropriate justifications should be written down at this time if needed.

8. Now you get to use the lensometer to determine the prescription. Write down the readings for both lenses including prism and multifocal adds if applicable.

9. Figure the decentration at this point.

10. The segment heights may be measured off the old pair. Be careful, this is an important measurement because the patient is used to the old segment height.

11. Last but not least, put in the prescribing officer's name for the all important signature.

There may be an occasion when you will want to use a lens clock to measure the base curve. This could make the critical difference as to whether or not the patient will be happy with your work. The measurement of base curves is usually necessary on sphere powers that exceed ± 4.50 D and cylinder powers that exceed ± 2.50 D. At any rate, it is generally up to the patient's tolerance for change. Some can accept change in the BC easily, some never can, so beware.

Duplicating a pair of spectacles exactly is a skill worth being proud of. You'll never know how much your patients depend on your skills and expertise.

ANATOMY AND PHYSIOLOGY OF THE EYEBALL

OBJECTIVES

II During this unit of instruction you will be given information on:

- Anatomy and Physiology of the Eyeball
- Types of ametropias and their correction

II-2a Given WS J3ABR91235-000-II-2a, identify the anatomy and physiology of the eye with 70% accuracy.

b. Given WS J3ABR91235-000-II-2b, identify facts about acuity with 70% accuracy.

c. Given the necessary materials and an instructor selected patient, perform visual acuity testing with no more than two (2) instructor assists.

d. Given the necessary materials and an instructor selected patient, take a case history with no more than one (1) instructor assist.

INTRODUCTION

When measuring Visual Acuity (VA), both you and the patients will have many questions about the "How and Why" of some of your measurements. For that reason, you must learn how various anatomical and physiological considerations influence visual acuities.

VISUAL ACUITY

INFORMATION

This unit is designed to give you basic information on the anatomy and physiology of the eye, and their relationship to visual acuity. Accepted types of visual acuity and factors influencing visual acuity are also discussed. Several methods of measuring clinical acuity are described.

DEFINITIONS

The following basic definitions will help you in your study of the anatomy:

Anterior - situated in front of or in the forward part of an organ.

Posterior - situated in back of or in the backward part of an organ.

Temporal - toward the temple.

Nasal - toward the nose.

Superior - located or directed upward in relation to the eye.

Inferior - located or directed downward in relation to the eye.

Medial - toward or pertaining to the nasal side of the eye.

Lateral - toward or pertaining to the temporal side of the eye.

Central - situated at or pertaining to the center of a structure.

Peripheral -situated away from the center or central structure.

Superficial - pertaining to or situated near the surface.

Deep - situated far beneath the surface.

Cross Section - a view of a plane surface exposed by cutting through an organ at right angles to its axis.

THE OCULAR TUNICS AND MEDIA

The eyeball is composed of three coats or tunics. From the outside of the eyeball inward, these coats are called the:

1. Fibrous tunic
2. Vascular (Uveal) tunic
3. Nervous tunic

The Fibrous Tunic (Figure 1-1)

The outermost layer or tunic of the eye is called the FIBROUS TUNIC. The function of this tunic is protective. The posterior 5/6 of the fibrous tunic is white and opaque and called the SCLERA. The anterior 1/6 is transparent and is called the CORNEA.

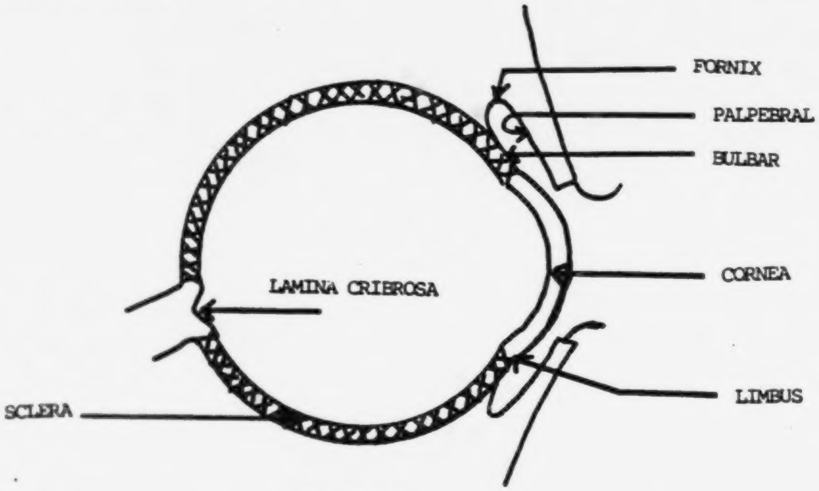


FIGURE 1-1

The cornea is a little more steeply curved than the rest of the eye and appears as a slight bulge if viewed from the side. Most corneas are slightly oval in shape rather than round - the horizontal meridian is slightly longer than the vertical. The average diameter is 11-12 mm.

The center of the cornea is thinner than periphery (.8 mm and 1 mm).

Most refraction of light rays occurs at the cornea. The cornea has a refractive power of about +45 D.

The limbus is the transition zone between the cornea and sclera. It can be seen as the grayish or translucent ring around the circumference of the cornea.

Histologically the cornea has five layers. Beginning with the outer layer they are: the surface epithelium, Bowman's membrane, stroma (substantia propria), Descemet's membrane, and the endothelium. The surface epithelium is made up of only five layers of cells, which are easily abraded or rubbed off by foreign bodies or ill-fitting contact lenses. Fortunately, the cornea heals very quickly -- often in a matter of hours unless the deeper layers are injured. If deeper layers are lacerated, scarring may occur.

The posterior 5/6 of the outer tunic is the sclera. The sclera makes up the white of the eye.

The sclera may appear bluish in young children due to its thinness and the uvea showing through. Fat deposits may cause the sclera to appear yellowish in old age.

The sclera is thickest in its posterior portion (1 mm) and thins as it is traced forward. It's also very thin at the insertion of the muscles.

The sclera is pierced by many holes at the posterior pole where the optic nerve attaches to the eyeball. These holes allow the axones of the nerve to pass through. This area is called the lamina cribrosa.

There are three major classes of openings in the sclera -- posterior, middle, and anterior, through which pass blood vessels and nerves.

The CONJUNCTIVA is an epithelial membrane which covers the front of the sclera and continues onto the back surface of the lids. There are two divisions of the conjunctiva: The bulbar covering the eye and the palpebral lining the lids. The bulbar division is the most posterior. The fornix is a junction where the palpebral and bulbar meet.

The Vascular Tunic (Figure 1-2)

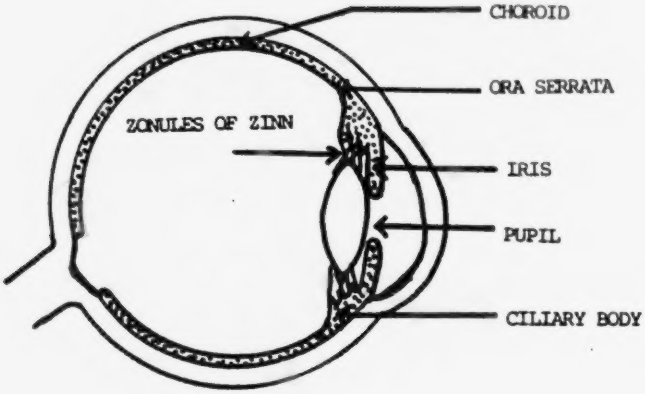


FIGURE 1-2

The UVEAL TRACT or VASCULAR TUNIC is located just beneath the fibrous tunic. The uveal tract is divided into three parts--the CHOROID, the CILIARY BODY, and the IRIS. The color of the uveal tract is dark brown due to the presence of melanin, a pigment.

The choroid runs from the optic nerve head to the ora serrata, and is attached to the globe at these two places.

Histologically, the choroid is composed of blood vessels and capillary nets.

The function of the choroid is to supply blood to the other layers of the eye.

The ciliary body runs forward from the ora serrata to the iris.

Histologically, the ciliary body is composed of blood vessels and muscle fibers. The muscle fibers extend to the ciliary processes. From these, tiny string like extensions called suspensory ligaments, or Zonules of Zinn, insert into the periphery of the lens capsule.

The function of the ciliary body is to cause changes in the shape of the lens. This is the accommodative (focusing) mechanism of the eye, and will be discussed more fully later. It is also where the aqueous humor is produced.

The iris is the most anterior portion of the vascular tunic and is attached to the ciliary body.

There is a hole in the center of the iris called the pupil.

The function of the iris is to limit light entering the eye. It regulates the amount of light by changing the size of the pupil.

When we speak of the vascular tunic of the eye, we must remember that this structure is an extension of the vascular system of the body. Since the body is supplied by a single closed-circuit vascular system, the eye may be affected by incidents occurring in other parts of the body. Also, the vascular tunic of the eye does not nourish all of the ocular structures. The eyelids, the muscles that move the eye, and most of the other structures in the orbital area receive nourishment from branches of the ophthalmic artery and the infraorbital artery. After passing through capillaries located in the orbital tissues, the blood leaves the orbital area by way of the vortex and ophthalmic veins.

The Nervous Tunic (Figure 1-3)

The RETINA or NERVOUS TUNIC is a direct extension of the brain, and is the innermost of the three tunics. It is attached to the rest of the eye at the optic nerve head and at the ora serrata. In the healthy eye, the retina is transparent.

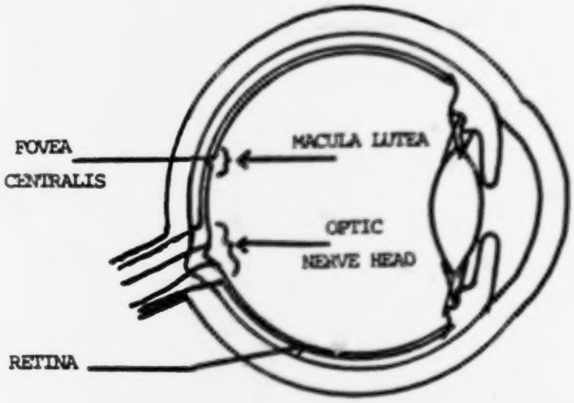


FIGURE 1-3

The retina has several landmarks -- the optic nerve head which has no visual receptors and the macula lutea which has a depression called the fovea centralis. Our clearest vision is in the area of the fovea centralis (all cones). The ora serrata is the most anterior portion of the sensory portion of the retina.

The retina is divided into ten (10) layers. The outermost layer is a layer of pigment. Touching the inner side of the pigment layer is the layer of rods and cones. Inside this layer are layers of membranes and cell nuclei, and a layer where the rods and cones synapse with bipolar cells. There is also a layer where the bipolar cells synapse with ganglion cells. The ninth layer is the nerve fiber layer -- axones of the ganglion cells. The tenth layer is a membrane separating the retina from the vitreous.

The light-sensitive elements of the retina are the rods and cones. Light passes through these cells "backwards" to stimulate the cells. These cells are named "RODS" and "CONES" because of their shape. (Figure 1-4)

Cones contain the chemical iodopsin. Most cones are found in or near the fovea, cones are used for color vision ("fine grain") and operate under high light levels (photopic conditions).

Rods contain rhodopsin, are not found in the fovea, are more numerous than cones (6 million cones vs 120 million rods per retina), see only black and white ("coarse grain") and operate under low light levels (scotopic conditions).

The "duplicity theory" states that there are two visual systems - one for low light levels (scotopic) and one for high light levels (photopic).

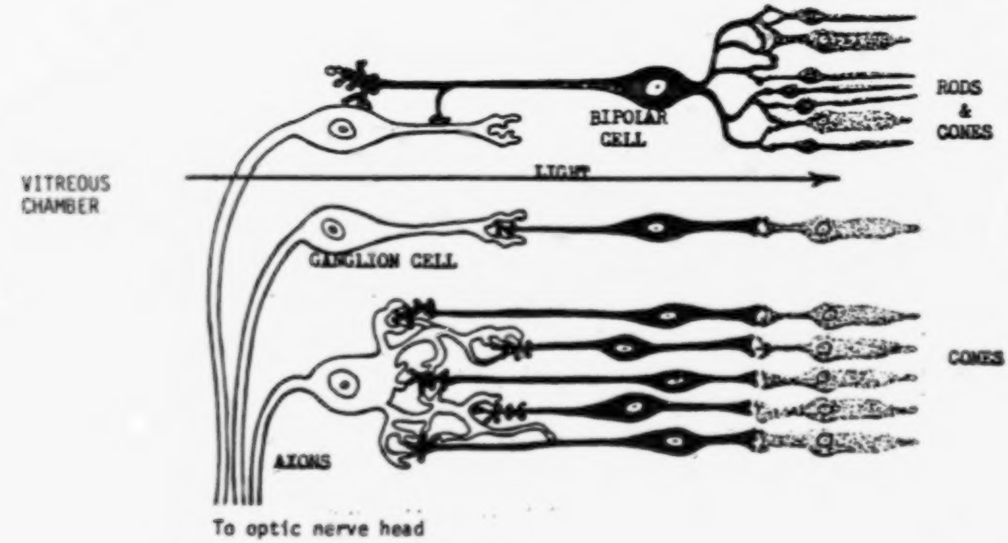

RODS
&
CONES
BIPOLAR
CELL
VITREOUS
CHAMBER
LIGHT
GANGLION CELL
CONES
AXONS
To optic nerve head

Figure 1-4

Since there are no rods or cones in the optic nerve head, there is a "blind spot" or scotoma in each eye -- an area where nothing is seen. The optic nerve head is the area where the axons of the ganglion cells leave the eye. The optic nerve connects the retina to the higher visual centers.

As mentioned before -- vision is sharpest (visual acuity is best) at the fovea -- it falls as the periphery is approached. Night vision, however, is sharpest at about 2° from the fovea or in the periphery of the macula lutea.

THE OCULAR MEDIA

A general term for the transparent structures of the eye is ocular media (or refractive media). We have already discussed the first of these, the cornea. The other ocular media are the aqueous humor, the crystalline lens, and the vitreous humor (Figure 1-5).

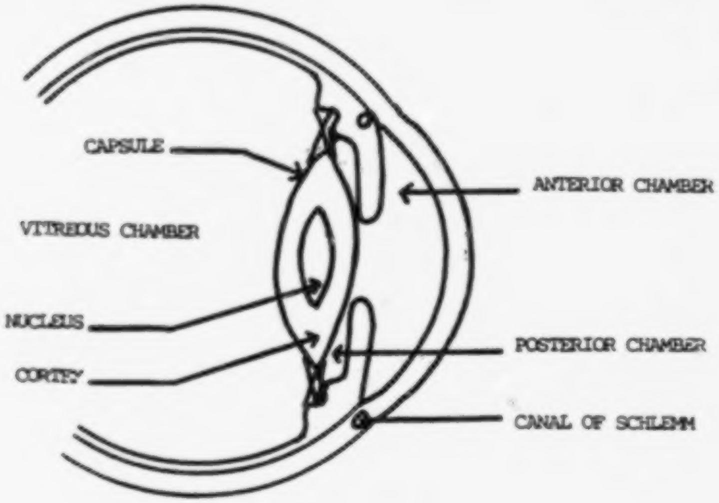

CAPSULE
ANTERIOR CHAMBER
VITREOUS CHAMBER
NUCLEUS
POSTERIOR CHAMBER
CORTEX
CANAL OF SCHLEMM

FIGURE 1-5

Aqueous Humor

The aqueous humor is found in the anterior and posterior chambers. The anterior chamber is the area between the back surface of the cornea and the front surface of the iris. The posterior chamber is a small space just behind the iris and in front of the crystalline lens.

Most authorities agree that the aqueous is produced continuously in the posterior chamber by the vascular plexis of the ciliary body. The aqueous flows into the anterior chamber through the pupil and is drained from the eye through the canal of Schlemm. This canal is located in the angle of the anterior chamber under the trabecular meshwork.

The aqueous is clear and colorless with a watery-like consistency (99% water). It has an index of refraction of 1.3336. In addition to being a refracting medium, the aqueous probably nourishes the crystalline lens and cornea.

Whenever aqueous is lost because of surgery or perforating injury, the lost aqueous will be replaced in a few hours once the wound is closed.

Crystalline Lens (Figure 1-5)

The little lens just behind the iris is called the crystalline lens because of its clarity and transparency. The crystalline lens is an elastic, biconvex structure composed of an outer capsule surrounding a cortex and nucleus.

The lens is about 10 mm in diameter and approximately 5 mm thick. Both the diameter and thickness of the lens vary according to the state of accommodation (or focus of the eye). (We will discuss accommodation in a later unit.) The crystalline lens is suspended within the eye immediately behind the iris behind the suspensory ligaments (or zonules of Zinn). The suspensory ligaments link the lens to the ciliary muscle.

The crystalline lens has an index of refraction of 1.386 in the cortex and 1.406 in the nucleus. The power of the lens is approximately +12 D. (The total power of the eye is about +60 D.)

As previously stated, the lens is normally clear and transparent. In some cases, the lens becomes opaque or translucent. The condition in which the lens is partially or entirely opacified is called cataract. Remember that cataracts are not external but internal problems.

Most cataracts cannot be prevented or kept from progressing. Once they have progressed to a certain stage, surgical removal is usually indicated. When cataract surgery becomes necessary, the entire crystalline lens must be removed. The condition in which the lens has been removed is called aphakia.

Vitreous Humor

Just behind the crystalline lens, and filling the posterior 5/6 of the eye, is the vitreous humor. The vitreous humor fills the vitreous chamber. The chemical composition is very similiar to aqueous (99% water), but the vitreous is a gel slightly thicker than the white of an egg.

The vitreous is enclosed in a thin membrance and adheres closely to the retina, expecially at the ora serrata and around the optic disc. A firm attachment may sometimes be found around the macula. Unlike aqueous, if vitreous is lost through injury or surgery of the eye, it is not replaced by the eye.

The index of refraction of the vitreous ranges from 1.3345 to 1.3348.

A common patient complaint is one of seeing little black spots floating in their field of vision. Often times these spots are shadows of particles floating in the vitreous. These vitreous floaters may or may not be indicative of eye disease.

AMETROPIA

Ametropia is any refractive condition in which, when the eye is at rest, parallel rays of light do not focus on the retina. The ametropias (refractive errors) may be divided into hyperopia (farsightedness), myopia (nearsightedness), and astigmatism. A fourth condition, presbyopia, is a gradual loss of ability to focus clearly on near objects. (Presbyopia will be covered in a later section of this SW.) In a normal population, 10 to 25% of the people will have no refractive error. This condition is called emmetropia. In emmetropia, when the eye is at rest, parallel rays of light do focus on the retina. (Figure 1-6)

Hyperopia (Figure 1-6)

Hyperopia is a condition in which parallel light from a distant source would focus behind the retina when the eye is at rest. A hyperopic person with sufficient accommodative reserve (ability to focus) can see clearly at both farpoint and nearpoint. Therefore, many hyperopes will have 20/20 vision without their spectacles. The optical system of a hyperopic eye is too weak for the length of the eye, i.e., the eye is too short for the optics. Hyperopia is corrected by plus (+) lenses.

The term "farsightedness" is frequently used by the layman to indicate hyperopia. The term farsightedness is probably derived from the fact that hyperopes are more efficient visually at far than at near. A hyperope may be visually ineffective at both far and near, but will always do better at far. Hence, the term farsightedness. However, it is not a good term, because hyperopes may be able to see clearly at both far and near if their accomodation (focusing power) is sufficient.

Myopia (Figure 1-6)

Myopia is the condition in which parallel light from a distance source focuses before it reaches the retina. All myopes have reduced visual acuity at a farpoint, but their near vision is usually relatively good. In the myopic eye, the optical system is too strong for the length of the eye, i.e., the eye is too long for the optical system. Myopia is corrected by minus (-) lenses.

The term "nearsightedness" is the lay term which describes better vision at near than at far.

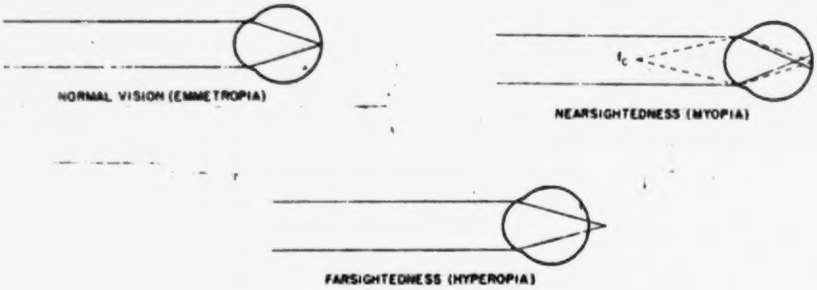


Figure 1-6 Schematic Showing Relation of Image to Retina of Eye at Rest for Normal Vision and Two Types of Refractive Errors

Astigmatism (Figure 1-7)

Astigmatism is a condition in which different meridians of the eye have different refractive powers. Most astigmatism is due to the shape of the cornea -- one principal meridian of the cornea has a greater radius of the curvature than the other. Some astigmatism may occur due to curvatures on other structures within the eye, for example, the crystalline lens.

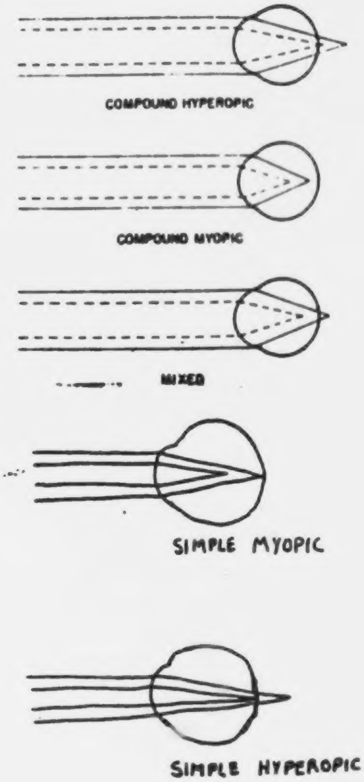


Figure 1-7. Five Types of Astigmatism

The astigmatic eye may be subdivided into five types. Simple astigmatism is a condition in which one meridian focuses on the retina and the other does not. Simple astigmatism may be myopic or hyperopic, depending on where the foci fall.

Compound astigmatism also exists. In this case, both foci fall in front of (compound myopic astigmatism) or behind (compound hyperopic astigmatism) the retina.

Astigmatism may also be mixed. This means that one focus is on one side of the retina and the other focus is on the opposite side (one meridian is hyperopic while the other meridian is myopic).

Simple astigmatism is corrected with simple cylinders (planocylinders). Other types of astigmatism are corrected by spherocylinders. Review your Block I notes on cylinders and spherocylinders at this time.

Other Related Terminology

ANISOMETROPIA. This is the condition where one eye has a refractive error different from the other eye.

ANTIMETROPIA. This is a condition where one eye is myopic and the other eye is hyperopic.

ANISEIKONIA. This is a defect of binocular vision, in which the retinal images of the same object differ in size between the two eyes.

Accommodation

Blurred images trigger the ciliary body to change the shape of the crystalline lens, so that divergent light rays entering the eye are focused directly on the fovea centralis.

Presbyopia

As people age their ability to accommodate decreases. This generally occurs after age forty and is called presbyopia. This loss of accommodation is due to the aging process of the crystalline lens. The crystalline lens, once very flexible, loses its flexibility. At age seventy, folks can't accommodate more than .25 Diopters, whereas before, at age ten they could accommodate as much as 14.00 Diopters.

EXERCISE II-2a

INSTRUCTIONS

This exercise is divided into four (4) separate parts. fill in the blanks.

PART I The eyeball

1. The outer layer of the eyeball is called the ______________ ______________.
2. The transparent portion of the outer tunic is called the ______________.
3. The pupil is located in the ______________.
4. The conjunctiva has two divisions. They are ______________ and ______________.
5. The superficial layer of the cornea is called ______________.
6. The transition zone between the sclera and the cornea is called the ______________.
7. The Vascular Tunic has three parts: the ______________, the ______________ and the ______________.
8. A general term for the transparent structures of the eye is ______________.
9. Aqueous flows from the posterior chamber to the anterior chamber through the ______________.
10. The ______________ of ______________ drains aqueous from the eye.
11. ______________ humor comes from blood vessels in the ______________ body.
12. Vitreous humor occupies the ______________ chamber of the eye.

PART II Refractive status of the eye

1. The ______________ is the strongest refractive media and has about ______________ diopters of power.
2. List four ocular media of the eye: ______________, ______________, ______________, ______________.
3. The condition in which parallel rays of light focus on the retina when the eye is at rest is called ______________.
4. Hyperopia is corrected by a ______________ lens, while myopia is corrected by a ______________ lens.
5. Another term for refractive error is ______________.
6. Diagram simple hyperopic astigmatism:

7. Diagram mixed astigmatism:

8. Diagram simple myopia:

PART III Accommodation

1. The muscular structure responsible for changing the shape of the crystalline lens is called the

______________________.

2. As a persons age increases his/her amplitude of accommodation ____________________________.

3. As you move closer to an object, you will require (more/less) accommodation to focus on the object clearly.

4. What attaches the crystalline lens to the ciliary body? _________________of _____________________.

PART IV Presbyopia

1. A 45 year old man who has had good near vision most of his life and now has trouble focusing on near objects is probably suffering from what conditon? ___________________________

2. Presbyopia develops as a result of the loss of elasticity of what structure? __________________________

3. A presbyope has better ________________ than _____________vision.

4. At what age does presbyopia generally have its most noticeable onset? _________________________________

VISUAL ACUITY

OBJECTIVE

II 2b Given WS J3ABR91235-000-II-2b, identify facts about visual acuity with 70% accuracy.

This unit will cover the following areas:

- Describe visual acuity
- Types of visual acuity
- The visual acuity chart
- Factors influencing visual acuity
- Relationship of visual acuity to ametropias
- Relationship of patient complaints to ametropia
- Basic techniques of measuring visual acuity
- Measuring VA
- Administer the + lens test
- Administer the pinhole disc test

INTRODUCTION

One of the basic functions of the eye clinic is to measure Visual Acuity (VA) of patients. You must perform this task with a high degree of accuracy and professionalism. You will be measuring the VA of almost every patient who enters your clinic, and accurate measurements are extremely important for proper patient treatment and medico-legal reasons.

Definition of Visual Acuity and Snellen Notation

Visual Acuity is a measure of the resolving power of the visual system; it is a measure of your ability to receive, transmit, and interpret visual images. In simpler terms, visual acuity is a measure of how well your eye "gathers" light from the objects you look at, how well the nerves in your visual pathway transmit information to your brain, and what the brain does with this information.

Visual efficiency, on the other hand, refers to how comfortably you see. Some people, even though they have 20/20 vision, do not have comfortable vision. We will discuss some conditions that cause uncomfortable vision later in this lesson.

Routine visual acuity tests in the eye clinic are usually form vision tests. Form vision includes detection, discrimination, and recognition of the letter or object being used as a test target. The most common test targets are the Snellen Letters.

We record visual acuity in Snellen Notation, 20/X, where 20 (the numerator) is the test distance and the X (the denominator) represents the smallest line the patient can read at a distance of 20 feet. 20/20 means that a patient can read the "20 foot" letter at 20 feet. A person who has poorer than average vision, 20/40 for example, can only read the "40 foot" letter at 20 feet. In other words, this person sees at 20 feet what an individual with 20/20 vision sees at 40 feet. Likewise, a person with 20/10 vision can see the "10 foot" letter at 20 feet while the person with 20/20 vision would have to move up to 10 feet in order to see the "10 foot" letter.

Since we always use Snellen Notation to record visual acuity in this course, you will need to be able to convert test results from distances other than 20 feet to the Snellen equivalent. Any time you use a test distance other than 20 feet you must convert your findings to 20/X. For example, in a case where the room isn't long enough for a 20 foot eye lane you would have to establish a test distance of 10 feet and reduce the letter size. The 20/20 letter would become the 10/10 letter (a 10 foot letter at 10 feet). As you can see, it is easy to convert 10/10 to 20/20, but what if the patient saw the 10/25 letter? -- To convert 10/25 to Snellen equivalent, set the problem up as a proportion, 10/25 = 20/X, and solve for X. 10/25 = 20/50.

A second example would be if the patient could not see the largest letter at 20 feet, you would have the patient walk toward the chart until he/she could see the largest letter. (The largest letter on the Snellen Chart is usually a "400 foot" letter, 20/400). Let's assume that the patient was 8 feet from the chart when he/she saw the 400 foot letter. You could write that as 8/400 (the patient saw the 400 foot letter at 8 feet) and then convert to Snellen equivalent. In this case, 8/400 = 20/X or, X = 1000. If you have trouble making these conversions, review "Solving For An Unknown In An Equation" in your Block I Study Guide.

Sometimes, people who have been examined in Britain or other European countries have their acuities recorded as 6/6. This means the test distance was 6 meters and the patient could read the 6 meter letter. 6/6 is equivalent to 20/20, 6/3 is equivalent to 20/10 and 6/12 is equivalent to 20/40, etc.

We often record near point acuities with 14 or 16 as a numerator, this means that the test distance is 14 or 16 inches. 14/14 is equivalent to 20/20, 14/7 is equivalent to 20/10 and 14/28 is equivalent to 20/40.

Letter Construction

All letters are assumed to have five components, as in Figure 2-1. In order to have visual acuity of 6/6, 10/10, 14/14 or 20/20, each component of a letter must have an angular separation of at least 1 minute of arc at any of the above test distances. The total letter will subtend an angle of 5 minutes of arc at the appropriate test distance.

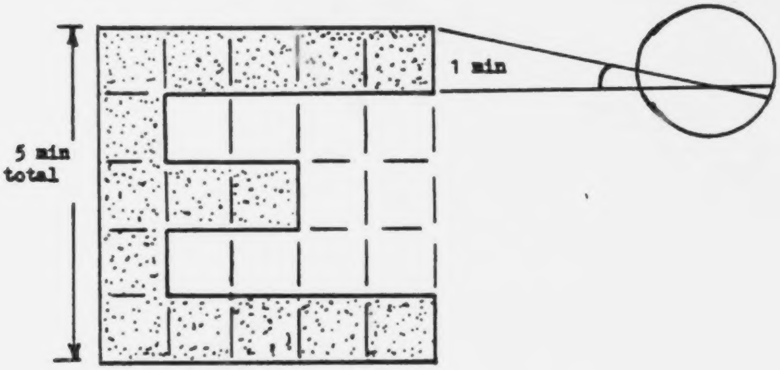


Figure 2-1

These three trees (Figure 2-2) form the same angle at the eye and might appear to be the same height to an observer. However, since they are different distances from the eye they would really be different heights. In other words, the angle remains the same, but the actual height varies.

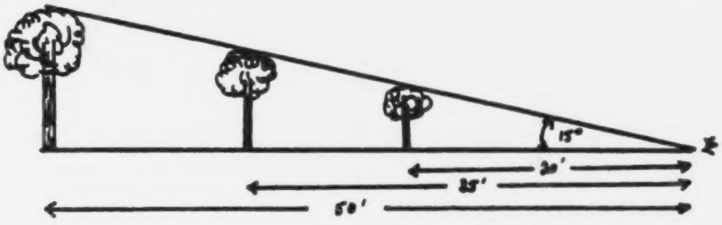


Figure 2-2

The same principle can be applied to a letter calibrated for various distances. A 20/200 E is 89 mm high at 20 feet, at a distance of 10 feet, the 20/200 E should only be 44.5 mm high. Both letters would then form the same angle at the eye. If the 20/200 E is moved to 10 feet from the patient and not reduced in size, it becomes a 20/400 E (10/200 = 20/400)! The reason for this is simple -- an 89 mm letter at 10 feet forms an angle twice as large as it did at 20 feet. Therefore the angle of a 20/200 letter placed at 10 feet is the same as the angle of a 20/400 letter placed at 20 feet.

In addition to the Snellen Chart, we use some special charts for small children or patients who are illiterate in the English language. You will have an opportunity to use some of these charts in the classroom. Most of the illiterate charts use the same principle as the Snellen Chart.

Testing Patients Who Cannot See the Chart

As already mentioned, some patients cannot see the largest letter on the eye chart. Usually we have these patients walk toward the chart until they can see the largest letter and note the distance. However, we usually do not allow a patient to approach any closer than 3 feet from the chart. Should a patient not be able to see the largest letter at 3 feet, we use Finger Vision.

In the Finger Vision test, we ask the patient to identify how many fingers the examiner is holding up. Record this acuity as C.F. (Count Fingers), followed by the test distance. For example, C.F. 5 feet -- means the patient correctly counted fingers at five feet.

If a patient can't count fingers at a distance of about 6 inches, we use the hand motion test. Ask the patient whether or not your hand is moving. If the patient can detect hand motion, record this acuity as Hand Motion.

Should a patient not be able to see hand motion, use the light localization test. Perform this test in a dark room and ask the patient to point to a flashlight as you move it to different positions. Record this test as L.L. (light localization).

Finally, if a patient cannot identify the direction of a light source, do the light perception test. In this case, ask the patient whether the room lights are on or off. Record as "L.P. only" if the patient can detect light. If the patient cannot detect light, record as No L.P.

Factors Influencing Visual Acuity

Many factors influence visual acuity. Among these are: region of the retina stimulated, illumination, spectral quality of light, contrast, pupil size, time of exposure, patient's age, condition of the ocular media, presence of ametropias and individual variations.

REGION OF THE RETINA STIMULATED. The fovea centralis is the retinal area of keenest vision. Visual acuity progressively reduces as the image falls further and further from the fovea. This is because the number of cones decrease toward the periphery of the retina.

Remember, that cones function in bright light and rods are used in dim light (photopic and scotopic vision). Since the scotopic system has poorer resolving power than the photopic system, visual acuity is poorer under dim light (other factors, such as reduced contrast also play a part). Night vision is the ability to detect, recognize, or resolve images under low illumination.

The greatest number of rods per area of retina exist just outside of the fovea. Under low illumination (scotopic conditions), vision is better just off the fovea. For example, a very dim star in a dark sky can be seen depending on whether you are looking just a little to one side of it or directly at it. If it is a very dim star it will actually disappear if you try to look directly at it. Figure 2-3 shows the type of receptor in use under various light conditions.

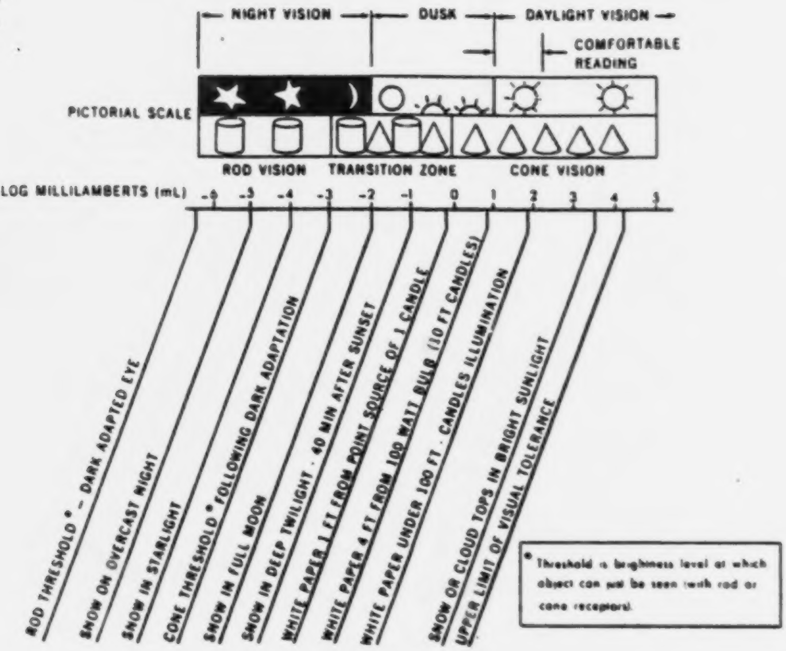


Figure 2-3

SPECTRAL QUALITY OF THE LIGHT. The spectral quality of light refers to its color (or wavelength). Cones are most sensitive to light of 555mu which is close to yellow. Under photopic conditions, the easiest color to see is yellow, the next easiest is white, then red, green and blue. Under scotopic conditions, the color blue is best seen.

CONTRAST. A black letter on a white background is easier to see than a black letter on a grey background. For a given intensity of illumination, visual acuity decreases as contrast decreases.

PUPIL SIZE. The eye has aberrations similar to the aberrations found in lenses.When pupils are large, peripheral light rays cause aberrations that tend to reduce acuity; a small pupil eliminates most of the aberrations. However, if the pupil is too small, the diminished amount of light entering the eye reduces visual acuity. Under average light conditions, a 2mm to 3mm pupil is considered optimal.

TIME OF EXPOSURE. As might be expected, if the time exposure to a target is very short, visual acuity is often less than if the exposure were longer.

AGE. Visual acuity declines somewhat with age. Acuity is probably at its best between the ages of 15 and 20.

CONDITION OF THE OCULAR MEDIA. Any abnormality of the ocular media, (corneal scarring, cataracts, etc.), will tend to reduce visual acuity.

PRESENCE OF AMETROPIAS. Any refractive condition which prevents light rays from focusing clearly on the fovea will reduce visual acuity. Ametropia is any refractive error such as myopia, hyperopia, or astigmatism. (Ametropias will be discussed more fully later.) Some patients can overcome or compensate for part of their refractive error by "straining" their eyes and thus have 20/20 visual acuity without spectacles. Other patients squint their eyes and get better vision. We will discuss how squinting allows better vision later. Since patients can adjust their vision somewhat, you never should state that he/she does or does not need glasses solely on the results of a visual acuity test.

INDIVIDUAL VARIATIONS. This refers to the ability of the nervous system to be stimulated and to transmit the impulses to the brain.

MEASURING AND RECORDING VISUAL ACUITY

OBJECTIVE

II 2c Given the necessary materials and an instructor selected patient, perform visual acuity testing with no more than two (2) instructor assists.

The following areas will be covered in this unit:

- Basic techniques of measuring visual acuity
- Measuring VA
- Administer the + lens test
- Administer the pinhole disc test

The visual acuity test is part of the subjective examination; the patient must respond in some manner to a stimulus presented by the examiner. In the performance of the various tests and the recording of results, a set procedure should be established and followed. The eyes should always be tested and the results recorded in the same order, so that there will be less likelihood of error. Procedures may vary slightly from clinic to clinic, but the following procedure is commonly used in testing visual acuity.

1. Each eye is tested separately; the eye not being tested is covered.

2. The right eye is usually tested first and recorded immediately. The abbreviations "R" for right eye, or "OD" for the Latin oculus dexter, are used to record the results.

3. The left eye is usually tested second and recorded immediately. The abbreviation "L" for left eye, or "OS" for the Latin oculus sinister is used.

4. If both eyes are tested together after testing the eyes individually, the abbreviation "OU" for oculus uterque is used.

5. If the patient wears glasses, tests of his/her visual acuity are normally done without glasses and then with glasses. Screening or survey tests may be given with the "habitual Rx", meaning the patient takes the test with glasses if any are worn.

Farpoint Tests

ILLITERATE TESTS. If the patient is illiterate, or a child who cannot read letters, the tumbling E chart or Landolt C chart is used. The patient is asked to identify which direction the arms of the E or the break in the C point. Children may be asked to point their fingers in the same way the "fingers" of the picture point. An object chart may also be used where the patient is asked to identify the object. Test procedure is the same as stated above.

SNELLEN TEST. If the patient is literate, the Snellen test card or Snellen projecto-chart letters may be used. The Snellen test charts for distant vision contain square-shaped letters which diminish in size from the top line downward. The largest letter, which is on the top line, can be read by a person with normal vision at a distance of 200 feet (some charts have a 400 foot letter). The next lines can be read at 100, 80, 70, 60, 50, 40, 30, 25, 20, 15 and 10 feet respectively. These distances are noted on the chart opposite each line of letters.

Score Reading

To measure visual acuity, we try to determine the smallest line the patient can read. The problem is which line do you give credit for, when a patient misses some letters on a line. We consider correctly reading 50% or more of the letters on a line as passing for that line. For instance, suppose a patient gets three letters correct on the 20/30 line which contains six letters, and cannot see the 20/25 line. You should record the patient's score as 20/30 -; the patient read 50% of the 20/30 line and the "-" tells us the patient missed some of the letters on that line. Or, suppose a patient reads all of the letters on the 20/40 line and gets two letters correct on the 20/30 line. In this case, we would record the score as 20/40 +; the patient was able to read all of the 20/40 line and the "+" tells us the patient was able to read some of the letters on the 20/30 line, but not over half of them.

There are several ways to record visual acuities, however, here in the course use the following format:

EXAMPLE: DVA$\overline{\text{sc}}$ OD 20/30 - DVA$\overline{\text{cc}}$ OD 20/20
OS 20/40 + OS 20/20
OU 20/30 OU 20/20

We use DVA to indicate distant visual acuity. The "$\overline{\text{sc}}$" means without correction and the "$\overline{\text{cc}}$" means with correction.

Likewise, we use NVA to indicate near visual acuity and record exactly the same as the distance.

EXAMPLE: NVA$\overline{\text{sc}}$ OD 20/40 NVA$\overline{\text{cc}}$ OD 20/20
OS 20/50 OS 20/20
OU 20/40 OU 20/20

The Projectochart

One of the most commonly used instruments in the clinic is the American Optical Projectochart (or the Bausch & Lomb equivalent), NSN 6515-00-388-3600 Projector, Ophthalmic Acuity Test. This instrument is essentially a slide projector with special ophthalmic slides. Screens are supplied with the instrument. Lens tubes may be specially designed for either a 15 or 20 foot room or a 10 to 14 foot room. Replacement bulbs (B & L #1217L) may be ordered through medical supply.

In order to accurately project a letter of the proper size, the projectochart must be positioned correctly. The projector tube should be on the same horizontal plane as the reflective screen. The proper size of the projected letters is assured by calibrating in the following manner.

1. Measure distance from screen to patient's eyes.

2. Place projectochart three or four feet in front of a patient and a little to one side. Plug instrument into a convenient 115 VAC outlet. Insert slide and turn on instrument.

3. By loosening the knurled ring near the base of the tube, the objective lens will be allowed to slide in its mount. Adjust the objective lens so that the image of the letters is clear and sharp. Now place the test distance template supplied with the projector against the reflective screen. Adjust the screen-projector distance (or the extension tube on newer models) until the vertical dimensions of the 20/200 E coincide exactly with the vertical scale for the test distance which you are using. If your test template is missing, use the following heights:

Chair-screen distance	20/200 E height
20'	89 mm
15'	66 mm
10'	44 mm

Intermediate heights may be calculated.

If you remember that the 20/200 E is 89 mm high when the patient's eyes are 20' from the screen, you can calculate what the height should be for any test distance by simply solving for the unknown. For example, if you want to know the height of the 20/200 letter when the patient's eyes are 12' from the screen, set up the proportion below:

$$\frac{20'}{89\text{mm}} = \frac{12'}{X\text{mm}}$$

solving for the unknown:

$$20X = 1068;\ \text{then } X = \frac{1068}{20} \text{ or } X = 53.4 \text{ mm}$$

4. Readjust the focusing tube and the screen-projector distance so that the proper size image is clear and sharp.

5. Mark the floor near the base of the stand to facilitate repositioning of the projector after moving it for cleaning or repairs.

The horizontal selector slide is used to provide either a full square image or a vertical line image. The red-green filters are used in the Duochrome test. Due to the chromatic aberration of the eye, a hyperope will see letters in the green clearer than letters in the red. The opposite is true for a myope. The vertical slide control knob changes projected areas of the slide. The small lever horizontal line selector provides a horizontal line of letters, or in conjunction with the vertical line on the selector slide, will provide viewing of single letters.

Maintenance of the projectochart is relatively easy. Clean the glass slides and lenses in the focusing tube by wiping them with a soft, dry, clean cloth. Never attempt to remove the lenses from the focusing tube. Lamp replacement is accomplished in the following manner: Press lamphouse release button near top of lamphouse, allow lamphouse section to swing back on its hinges, remove inner lamphouse by pulling top back towards you until spring clips have disengaged, then lift out; the lamp has a bayonet socket and may be removed by pressing down, twisting counterclockwise, then lifting out. Do not attempt any further disassembly! CAUTION: If the lamp was on prior to removing the bulb, the housing may be extremely hot. Before inserting new lamp, insure that all fingerprints have been wiped from it, otherwise the bulb may crack when hot.

EXERCISE II-2b

INSTRUCTIONS

Answer the following questions in the spaces provided.

1. In measuring visual acuity, which do you test first: right eye, left eye or both eyes together?

____

2. During a survey or screening test, measuring the visual acuity with glasses is a measure of the

____________________ visual acuity.

3. O. D. means ____________________________________

O. S. means ____________________________________

O. U. means ____________________________________

4. An exam room is 20 feet long. The distance between the patient's eyes and the reflective screen of a projectochart is 18 feet. When the projector is at the proper distance, what will be the correct height of a 20/200 letter E? ______________________________

5. What tests can be used to measure visual acuity if the patient is illiterate? ______________

SCREENING FOR AMBLYOPIA OR AMETROPIA

Sometimes a patient has healthy eyes but cannot see well with one eye. If the patient's vision cannot be improved by sighting through a pinhole, or by lenses, he/she is said to be amblyopic. Clinical amblyopia is about 20/30 or worse, uncorrectalbe, in either eye.

Usually,ambylopia is associated with strabismus (heterotropia) and may begin with suppression of vision in one eye. Suppression is a "turning off" or ignoring of the vision of one eye while both eyes are open. Suppression is the visual system's way of canceling double vision (diplopia) caused by strabismus. Sometimes suppression develops as a result of blurred vision in one eye caused by anisometropia. Suppression can only be found when the patient has both eyes open; if the non-suppressing eye is covered, the suppressing eye "comes back on" and usually can see pretty well if any refractive error is corrected. On the other hand if the patient has amblyopia, when the non-ambylopic eye is covered, the ambylopic eye still cannot see well.

The pinhole disc test is often used to screen for amblyopia or to estimate the patient's BVA (best visual acuity). If a patient shows poor VA on the standard visual acuity test (20/40 or worse), do a pinhole disc test. Instruct the patient to hold the disc in front of the poor eye while occluding the other eye. If the diminished acuity is due to a refractive error, the patient's acuity will improve with use of the pinhole; if the eye is amblyopic, no improvement in VA will occur. In other words, if a pinhole improves visual acuity, lenses will. If a pinhole doesn't improve VA, lenses won't either and the eye is either amblyopic or has poor vision due to an injury or disease. Sometimes an eye is both amblyopic and ametropic; in such a case the pinhole would improve the VA to whatever extent permitted by the amblyopia. For example,if an astigmatic eye shows 20/100 unaided and 20/50 with best correction (by a lens), a pinhole would also be expected to bring the eye close to 20/50. In other words, 20/100 could be thought of as being due to the combination of refractive error and amblyopia, while the 20/50 could be thought of as the patient's VA (BVA) when the refractive error is eliminated. Thus, the patient is amblyopic to the extent of 20/50.

When you perform a pinhole disc test, the score should be recorded as 20/X P. H. If a patient reads 20/30 through the pinhole, then record 20/30 P.H., etc.

The plus lens test may be administered in conjunction with any standard farpoint VA test. This procedure is designed to detect moderate to severe hyperopia in patients who do not wear glasses. It is done when the distance and near visual acuity is 20/25 or better. The procedure is the same as the basic farpoint visual acuity screening test, except that a +1.25 D sphere is held before the eye being tested. If the patient can still read the 20/25 line through the plus lens, he/she is evidently hyperopic to an extent equal to or greater than +1.25 D, and fails the test. If the patient reports the 20/25 line to be blurry, or can read it, then the patient passes the test. It means the patient has less than +1.25 D of hyperopia.

If the plus lens test is used in your clinic, it should be recorded as "Plus lens test, fails" or "Plus lens test, passes".

EXERCISE II-2c

INSTRUCTIONS

Answer the following questions in the spaces provided.

1. A patient's eye is healthy but visual acuity is worse than 20/30, is not corrected by lenses, and does not improve when sighting through a pinhole disc. This patient probably has ______________________.

2. The pinhole disc test should be used to differentiate between ___________________ and _____________.
   The plus lens test detects ____________ in patients who have ____________ uncorrected visual acuity.

3. A patient has OD 20/200, OS 20/50 and does not wear glasses. Through the pinhole, vision improves to OD 20/30, OS 20/20. Record these findings below.

4. A patient has 20/20 with each eye distance and near, and does not wear glasses. Vision through a +1.25 D sph at distance is blurry for both eyes. Record these findings below.

5. A patient has 20/60 in both eyes. The pinhole corrects both eyes to 20/25. What do you suppose is causing the 20/60 vision in each eye?

6. A patient has OD 20/20, OS 20/40. A plus lens gives OD 20/60 and the pinhole gives OS 20/20. What do you think the patient may need?

7. A patient has OD 20/400. The pinhole test gives OD 20/25, OS 20/200. What is probably wrong with the right eye?

   What is probably wrong with the left eye?

8. Differentiate between suppression and amblyopia.

CASE HISTORY

OBJECTIVE

II-2d Given the necessary materials and an instructor selected patient, take a case history with no more than one instructor assist.

INTRODUCTION

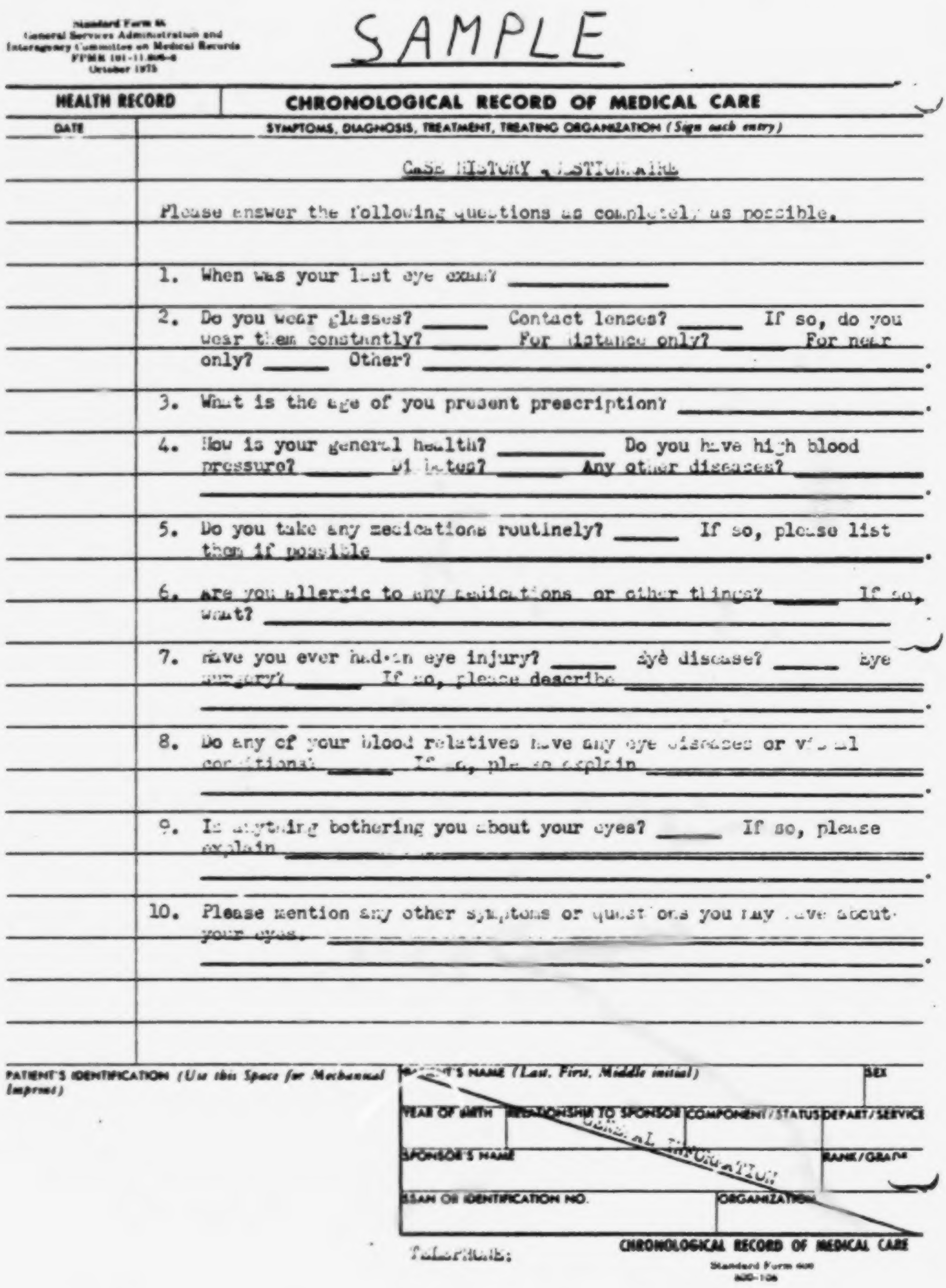
There is an old saying, "If you ask the patient what's wrong, the patient will tell you." There is a lot of truth to that old saying. In this unit, we will explore the best means to obtain this information from patients.

INFORMATION

PATIENT HISTORY (Hx)

There are different ways to elicit the patient's history, symptoms (Sx) and complaints. These will vary from Dr. to Dr. and from clinic to clinic. Some prefer a written questionnaire that is filled out by the patient, whereas others prefer a direct oral questioning technique. Figure 3-1 shows a sample questionnaire.

When using the direct questioning method, you should always be courteous, congenial,and professional in your approach. Some of the information you are trying to surface may be of a personal nature and difficult for the patient to talk about. Always remember that the information obtained should be held in the strictest confidence and should only be revealed to personnel with a need to know.



Standard Form 600
General Services Administration and
Interagency Committee on Medical Records
FPMR 101-11.806-8
October 1975

SAMPLE

HEALTH RECORD | **CHRONOLOGICAL RECORD OF MEDICAL CARE**

DATE | SYMPTOMS, DIAGNOSIS, TREATMENT, TREATING ORGANIZATION (*Sign each entry*)

CASE HISTORY QUESTIONNAIRE

Please answer the following questions as completely as possible.

1. When was your last eye exam? ______

2. Do you wear glasses? ______ Contact lenses? ______ If so, do you wear them constantly? ______ For distance only? ______ For near only? ______ Other? ______.

3. What is the age of you present prescription? ______.

4. How is your general health? ______ Do you have high blood pressure? ______ Diabetes? ______ Any other diseases? ______.

5. Do you take any medications routinely? ______ If so, please list them if possible ______.

6. Are you allergic to any medications or other things? ______ If so, what? ______.

7. Have you ever had an eye injury? ______ Eye disease? ______ Eye surgery? ______ If so, please describe ______.

8. Do any of your blood relatives have any eye diseases or visual conditions? ______ If so, please explain ______.

9. Is anything bothering you about your eyes? ______ If so, please explain ______.

10. Please mention any other symptoms or questions you may have about your eyes. ______.

PATIENT'S IDENTIFICATION (*Use this Space for Mechanical Imprint*)

PATIENT'S NAME (*Last, First, Middle initial*)	SEX

YEAR OF BIRTH	RELATIONSHIP TO SPONSOR	COMPONENT/STATUS	DEPART./SERVICE
SPONSOR'S NAME			RANK/GRADE
SSAN OR IDENTIFICATION NO.		ORGANIZATION	

GENERAL INFORMATION

TELEPHONE:

CHRONOLOGICAL RECORD OF MEDICAL CARE

Standard Form 600
600-106

Figure 3-1

Procedure

The history taking procedure is usually performed just after meeting and greeting the patient. This is an extremely important period because first impressions of you, your Dr. and the entire clinic will be made at this time. You should establish a good rapport with the patients and make them feel at ease. Be friendly and show a genuine interest in them. Next, make sure that the patient's general information, such as name, rank, SSAN, organization, telephone number, age and sex are entered in the appropriate place on the exam form. An excellent way to get most of this information is from the ID card.

In taking a history, you should attempt to be precise. Patients must be guided by your questions, since they don't know what is important and what is not. Don't let them go on and on about an old war injury which is not important for the eye examination.

One of the first areas we are interested in is the patient's present visual condition. When was their last eye exam? Do they wear glasses or contact lenses? When are glasses worn, for distance only, for near only, both, or for some specific task? If contact lenses are worn, are they hard or soft lenses? How many hours per day are they worn?

Next, we want to know about the patient's medical history. How do they view their general health? High blood pressure, diabetes, heart problems and arthritis are some of the most common diseases that can show up in, or affect the eyes. Are any medications taken routinely? Some medications can have side effects on the health of the eyes or cause visual disturbances. Do they have any allergies to medications or other things? The patient may be allergic to some drugs that the Dr. may need to use during the examination. If so, he needs to know ahead of time.

The patient's medical eye history is of great importance. Have they ever had an eye disease, a significant eye injury, or an eye operation? If so, when -- and what was the end result?

The Dr. would like to know something about the patient's family ocular history. Some things tend to run in families like glaucoma, cataracts, myopia, strabismus, etc. Does anyone in the immediate family have any eye diseases or vision conditions? As with family eye conditions, so it is with family medical problems. Ask if anyone in their immediate family has high blood pressure, diabetes or heart problems.

Last and probably the most important bit of information is the chief complaint. Some prefer to ask for this information first. What is the main reason that the patient has come to the optometry clinic? What seems to be bothering him/her about his/her eyes? You should be able to weed out the unimportant complaints like "my right eye itches once a month" and home in on the important ones like "the vision in my left eye has become blurry recently." Whenever there is a positive reply to any question, you should follow up with more specific questions in that area. For example, if the patient responds "I can't see too well", your next question might be -- "Do you mean with or without glasses? Does it happen all the time or just sometimes? Is it in just one eye or both? How long has this been going on?" etc.

CASE HISTORY CHECKLIST

ESTABLISH RAPPORT
GENERAL INFORMATION: Name, rank, SSAN, organization, phone, age, sex, etc.
LAST EYE EXAMINATION
GLASSES OR CONTACT LENSES WORN
GENERAL HEALTH
MEDICATIONS
FOR WHAT PURPOSE
ALLERGIES
EYE INJURIES, DISEASE, OR SURGERY
CHIEF COMPLAINTS

Here are some examples of taking and recording a case history. The following case histories are recorded in Figures 1-9 and 1-10.

CASE I

EXAMINER: Good morning Sergeant Linejudge! How are things going today?

PATIENT: Fine. How are you?

EXAMINER: Great! I'm going to ask you a few questions before Dr. Baum examines your eyes. (MOST OF THE GENERAL INFORMATION IS ALREADY ON THE EXAM FORM.) What is your age now?

PATIENT: Thirty.

EXAMINER: When was your last eye exam?

PATIENT: About two years ago.

EXAMINER: Were your glasses changed then? (Sgt Linejudge is wearing glasses so you, of course, you wouldn't ask him if he wore glasses).

PATIENT: Yes, they were made stronger.

EXAMINER: How is your general health?

PATIENT: Excellent.

EXAMINER: Do you take any medications routinely?

PATIENT: No, just when I catch cold.

EXAMINER: Are you allergic to any medications or other things?

PATIENT: No

EXAMINER: Have you had an eye disease, eye injury, or eye operation?

PATIENT: Yes, I got a piece of steel in my eye when I was drilling about four years ago.

EXAMINER: Was it treated by a Dr.?

PATIENT: Yes a Dr. removed it with a needle.

EXAMINER: Which eye was it?

PATIENT: The left.

EXAMINER: Has anyone in your immediate family ever had any eye diseases or vision conditions?

PATIENT: Yes, my grandmother has glaucoma and most of the family is nearsighted.

EXAMINER: Is anything bothering you about your eyes now?

PATIENT: Yes, I've noticed that I can't see the road signs very well any more when I'm driving.

EXAMINER: Is this the only time your vision is blurry?

PATIENT: The down marker is blurry when I referee ballgames and most distant objects are not clear.

EXAMINER: How long has this been going on?

PATIENT: For about the past 3 or 4 months.

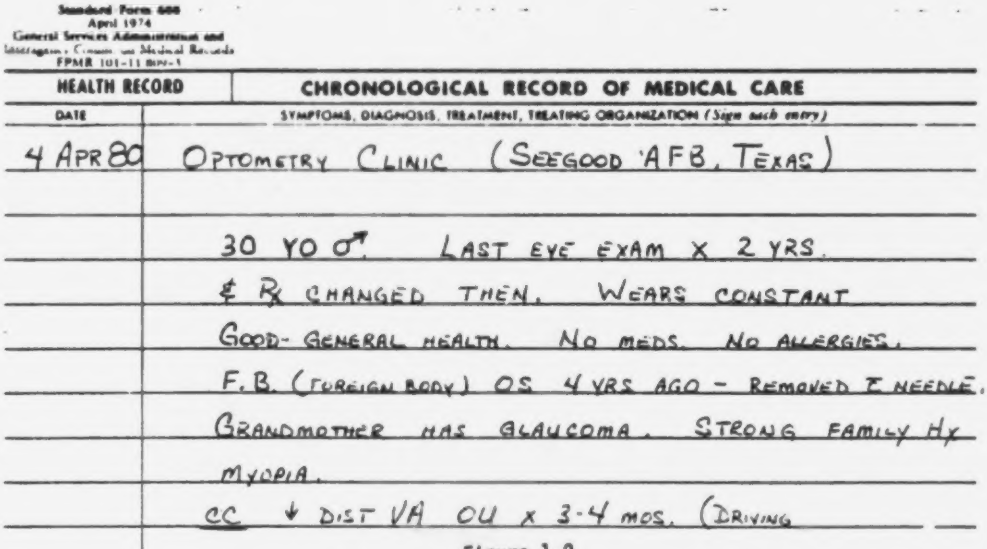
EXAMINER: In both eyes?

PATIENT: Yes.

EXAMINER: Are you having any other eye problems that we haven't mentioned?

PATIENT: No.

Notice how the examiner "followed up" on the piece of steel in the eye and the blurry road signs.



Standard Form 600
April 1974
General Services Administration and
Interagency Comm. on Medical Records
FPMR 101-11.806-8

HEALTH RECORD | **CHRONOLOGICAL RECORD OF MEDICAL CARE**

DATE	SYMPTOMS, DIAGNOSIS, TREATMENT, TREATING ORGANIZATION (*Sign each entry*)
4 APR 80	OPTOMETRY CLINIC (SEEGOOD AFB, TEXAS)
	30 YO ♂. LAST EYE EXAM x 2 YRS.
	& Rx CHANGED THEN. WEARS CONSTANT
	GOOD- GENERAL HEALTH. NO MEDS. NO ALLERGIES.
	F.B. (FOREIGN BODY) OS 4 YRS AGO - REMOVED c̄ NEEDLE.
	GRANDMOTHER HAS GLAUCOMA. STRONG FAMILY Hx
	MYOPIA.
	CC ↓ DIST VA OU x 3-4 MOS. (DRIVING

Figure 1-9

CASE II

EXAMINER: Hello Mrs Flintglass! How are you today?

PATIENT: Fine, how are you?

EXAMINER: Fine! I'm going to ask you a few questions about your eyes. May I see your ID card please? What is your age now?

PATIENT: Forty-eight.

EXAMINER: When were your eyes checked last?

PATIENT: Probably about three or four years ago.

EXAMINER: So you wear glasses?

PATIENT: Yes, I wear the bifocals in my purse when I read.

EXAMINER: Was the prescription for your glasses changed at the time of your last eye exam?

PATIENT: No, that's when I first got glasses.

EXAMINER: How is your general health?

PATIENT: Pretty good except I have diabetes.

EXAMINER: Is your health good otherwise?

PATIENT: Yes.

EXAMINER: How long have you been a diabetic?

PATIENT: About 8 years now.

EXAMINER: Do you take any medications?

PATIENT: Yes, I take a Diabinese pill twice a day.

EXAMINER: Are you allergic to any medications or anything else?

PATIENT: No.

EXAMINER: Have you ever had an eye disease, eye injury, or eye operation?

PATIENT: No.

EXAMINER: Has anyone in your family ever had any eye problems?

PATIENT: Yes, my father went blind from diabetes when he was about 70 years old.

EXAMINER Is anything bothering you about your eyes Mrs. Flintglass?

PATIENT: Yes, I'm having some trouble reading? My arms are too short!

EXAMINER: How long have you noticed this?

PATIENT: For about the last six months or so.

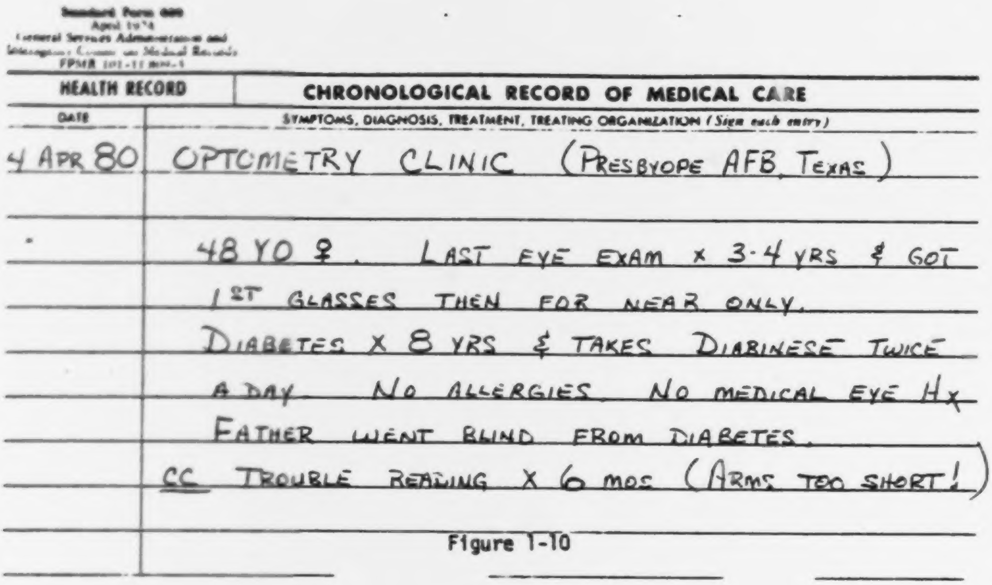
EXAMINER: Is your distance vision OK?

PATIENT: Oh yes.

EXAMINER: Are you having any other eye problems?

PATIENT: No.

Notice how the examiner "followed up" on the diabetes and about the trouble reading.



Standard Form 600
April 1974
General Services Administration and
Interagency Comm. on Medical Records
FPMR 101-11.806-8

HEALTH RECORD | **CHRONOLOGICAL RECORD OF MEDICAL CARE**

DATE | SYMPTOMS, DIAGNOSIS, TREATMENT, TREATING ORGANIZATION (*Sign each entry*)

4 APR 80 | OPTOMETRY CLINIC (PRESBYOPE AFB, TEXAS)

48 YO ♀. LAST EYE EXAM x 3-4 YRS & GOT
1ST GLASSES THEN FOR NEAR ONLY.
DIABETES x 8 YRS & TAKES DIABINESE TWICE
A DAY. NO ALLERGIES. NO MEDICAL EYE Hx
FATHER WENT BLIND FROM DIABETES.
CC TROUBLE READING x 6 MOS (ARMS TOO SHORT!)

Figure 1-10

EXERCISE II-2d

INSTRUCTIONS

Answer the following questions in the spaces provided:

1. Name two different ways to elicit a patient's history and complaints.

2. Why must the information obtained from the patient, during the case history, be held in the strictest confidence?

Who should have access to this information?

3. Why is it important to establish rapport with the patient as soon as possible?

4. What is one good way to get most of the general information from the patient?

5. Why would we want to know what medications a patient is taking?

What medications the patient may be allergic to?

6. What do you do whenever there is a positive reply to a question?______________________________

____

____

7. What is the most important part of the case history? (Tells you why the patient came to the optometry clinic.) ____

____

STUDY GUIDE AND WORKBOOK

J3ABR91235 000-III

Technical Training

Optomety Specialist

BLOCK III

ASSISTING THE OPTOMETRIST

January 1984

SCHOOL OF HEALTH CARE SCIENCES, USAF
Department of Biomedical Sciences
Sheppard Air Force Base, Texas 76311

Designed for ATC Course Use

DO NOT USE ON THE JOB

RGL: 11.0

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SW J3ABR91235 000-III-2	Ancillary Optometric Procedures	2-1

This supersedes SW 3ABR91235-III, January 1983. Previous editions may not be used.

Department of Biomedical Sciences
School of Health Care Sciences, USAF
Sheppard Air Force Base, Texas 76311

SW J3ABR91235000-III-1
January 1984

OCULAR MOTILITY

This study guide workbook (SW) is designed to give you basic knowledge in the anatomy and physiology of the bony orbit, the ocular adnexa, the extrinsic muscles, and the instrumentation and procedures to detect anomalies of ocular motility.

OBJECTIVES

a. Given WS J3ABR91235 000-III-1a,identify the anatomy and physiology of the bony orbit with 70% accuracy.

b. Given WS J3ABR91235 000-III-1b,identify the anatomy and physiology of the ocular adnexa with 70% accuracy.

c. Given WS J3ABR91235 000-III-1b,identify the anatomy and physiology of the extrinsic muscles with 70% accuracy.

d. Given the necessary materials and an instructor selected patient, perform ocular motility tests with no more than 1 instructor assist per test.

INTRODUCTION

Many "vision" problems encountered in the Eye Clinic are due to misalignment of the eyes. This SW will give you basic information on ocular motility testing as well as an introduction to the anatomy and physiology of the protective structures around the eye.

INFORMATION

THE BONY ORBIT

The bony orbit is that portion of the skull which houses the eyeball, extraocular muscles, optic nerves, lacrimal gland, lacrimal sac and orbital fat. The purpose of the orbit is to provide protection, support and attachment for muscles, eyeball, nerves and blood vessels which pass through the orbital cavity.

Each orbit is shaped like a four-sided pyramid; the wide portion being the aditus orbita or opening for the eyeball, and the narrow portion pointing toward the back of the head is the apex of the orbit. (Figure 1-1). There are four walls in each orbit, a floor, roof, lateral and medial wall.

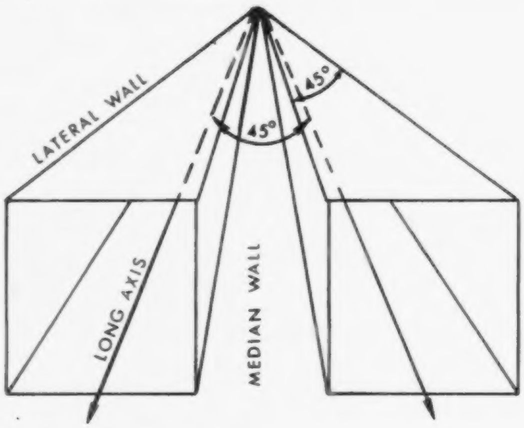


Figure 1-1

The maxillary, lacrimal, ethmoid and lesser wing of the sphenoid bones form the orbits' weakest wall, the medial wall. The weakest bone in the orbit is the ethmoid.

There are several openings in each orbit. The largest is the aditus orbita or opening of the eye. If you place your hand flat covering one eye, you'll be able to feel the outline of this opening. The remaining openings are divided into fissures (which look like cracks or crevices) and foramina (which look like holes). There are about nine of these openings per orbit. Their purpose is to allow the entrance and exit of nerves, arteries, and veins. The names and locations of the major openings can be found in (Figure 1-2). The two largest fissures in each orbit are the supraorbital and infraorbital fissures. The trochlear nerve (IV cranial nerve) passes through the supraorbital fissure. The optic nerve (II cranial nerve) passes through a foramen which is located at the apex of the orbit called the optic foramen.

In addition to fissures and foramina the orbit also has several indentations or depressions in the bones called fossae. These fossae accommodate auxillary structures within the orbit. The names and locations of the major fossae can be found in (Figure 1-2).

There are 7 bones which make up a single orbit, however, three of these bones (the frontal, the sphenoid, and the ethmoid) extend into both orbits making a total of eleven bones in both orbits.

Frontal
Sphenoid
Ethmoid
Zygomatic Zygomatic
Maxilla Maxilla
Lacrimal Lacrimal
Palatine Palatine
(right) (left)

The floor of the orbit is composed of three bones. They are the maxilla, palatine, and the zygomatic. The roof of the orbit is primarily made up of the orbital portion of the frontal bone, however, the lesser wing of the spenoid (a bat shaped bone with a lesser and greater wing) contributes to its make-up. The strongest bone in the orbit; the zygomatic, teams with the greater wing of the sphenoid to form the orbits' strongest wall, the lateral wall. (Figure 1-2).

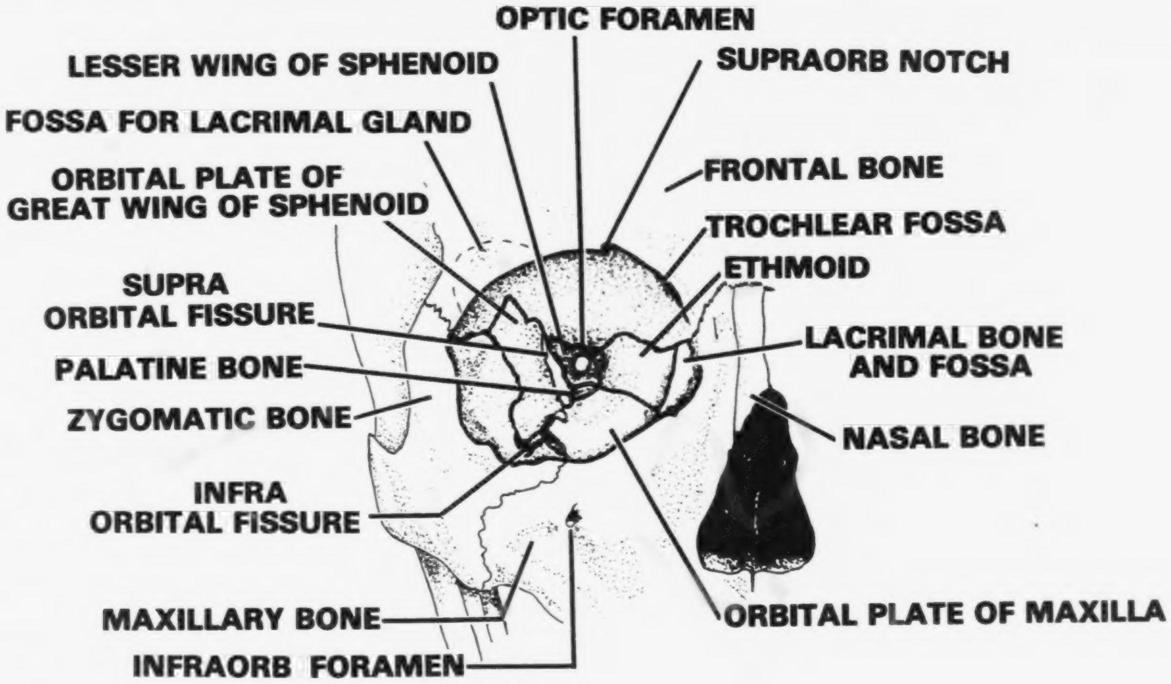

OPTIC FORAMEN
LESSER WING OF SPHENOID
SUPRAORB NOTCH
FOSSA FOR LACRIMAL GLAND
FRONTAL BONE
ORBITAL PLATE OF GREAT WING OF SPHENOID
TROCHLEAR FOSSA
ETHMOID
SUPRA ORBITAL FISSURE
LACRIMAL BONE AND FOSSA
PALATINE BONE
ZYGOMATIC BONE
NASAL BONE
INFRA ORBITAL FISSURE
MAXILLARY BONE
ORBITAL PLATE OF MAXILLA
INFRAORB FORAMEN

Figure 1-2

EXERCISE III-1a

INSTRUCTIONS:

Answer the following questions in the space provided.

Questions 1 through 7, list the bones which make up each orbit.

1. ____________________

2. ____________________

3. ____________________

4. ____________________

5. ____________________

6. ____________________

7. ____________________

8. The purpose of the openings in the orbit is to transmit ____________________, ______________, and ____________________ to and from the orbit.

9. Cracks or crevices in the orbit are called ____________ while holes in the orbit are called ______________.

10. There are ____________ bones in both orbits together.

11. The three bones common to both orbits are the ____________, ____________, and ____________ bones.

12. The orbit provides ____________, support, and attachment for the muscles and the eyeball.

13. The front opening in the orbit is called the ______________________.

14. The strongest orbital wall is the ________________ wall.

15. The weakest orbital wall is the ________________ wall.

16. The ______________, ______________, and ____________________ bones make up the floor of the orbit.

17. The strongest bone in the orbit is the ____________________.

18. The weakest bone in the orbit is the ____________________.

19. The smallest bone in the orbit is the ____________________.

20. The optic nerve passes through the ____________________________.

THE OCULAR ADNEXA

There are several structures or appendages of the eye that fall under the general term ocular adnexa. The adnexa can be divided into four groups:

1. Eyelid

2. Eyebrows

3. Accessory glands

4. Lacrimal apparatus

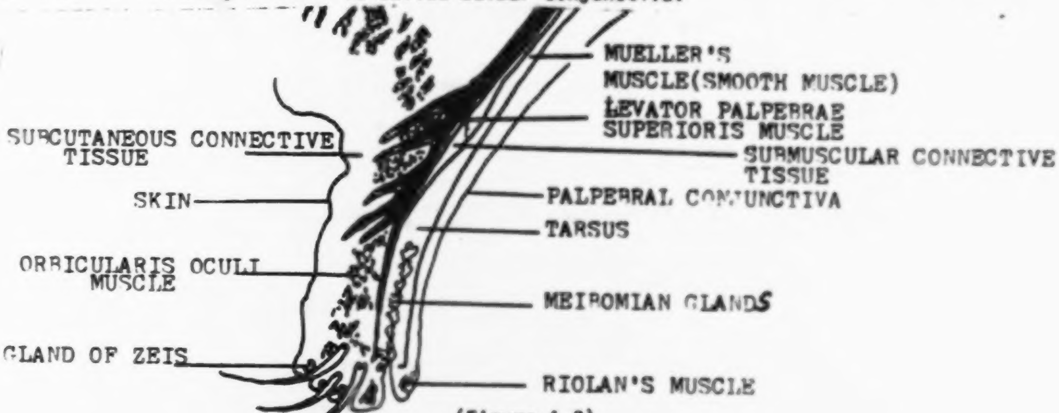
Eyelids (See Figure 1-3)

The primary function of the eyelids is protection, e.g., from bright lights, foreign objects. During sleep the eyelids form a protective cover which prevents the very sensitive cornea from becoming dry or "desiccated", which could lead to a loss of corneal transparency and loss of vision. When the eyes are open, normal blinking of the eyelids spreads the lubricating secretions of the eye over the surface of the eyeball. A condition where the lid margin turns in, called entropion can cause a foreign body sensation to the eye due to eyelashes touching the surface of the eye. On the other hand a condition where the eyelids turn out, called ectropion, can be just as undesirable. A condition where tears overflow onto the cheeks known as epiphora, can result from ectropion.

The inner and outer angles formed by the junctions of the upper (superior) and lower (inferior) eyelids are called canthi. The inner angle is called the medial canthus and the outer angle is called the lateral canthus. Located near the medial canthus is a structure, which looks like a half moon, called the plica semilunaris. The plica semilunaris is a remnant structure which corresponds to the third eyelid of lower vertebrates. Located nasally to the plica is a structure or bump called the caruncle. This bump keeps the eyelids slightly away from the eyeball so that the tears can collect and eventually drain from the eye.

The margin of each eyelid has a row of short, thick hairs, called cilia or eyelashes. The upper lid has about twice as many lashes as the lower lid. At the base or root of each eyelash there are sebaceous glands which produce an oily lubricating fluid. These particular sebaceous glands are called glands of Zeis. When a gland of Zeis becomes infected, an abcess called a hordeolum (stye), forms on the lid margin.

Each eyelid has seven layers. The first layer of the eyelid is skin. This is the thinnest skin on the body. The second layer is the subcutaneous (under the skin) connective tissue. It connects the skin to the third layer which is the striated muscle layer. The striated muscle layer consists of the orbicularis oculi muscle which is a sphincter muscle that closes the eye, and in the upper lid only, the levator palpebrae superioris which raises the eyelid. The levator is innervated by the oculomotor nerve (III cranial nerve) and the orbicularis oculi is innervated by the facial nerve (cranial nerve VII). Under the muscle layer is another layer of connective tissue called submuscular (under the muscle) connective tissue. The fifth layer is the fibrous layer which contains the tarsal plate. The tarsal plate makes up the body of the eyelid and serves as a plate for muscle attachment. It contains the meibomian glands which will be discussed later with the accessory glands. The sixth layer is the smooth muscle layer and consists of Mueller's muscle. The seventh or innermost layer is the conjunctiva. As you remember, it is the palpebral conjunctiva and folds over onto the eye in the fornix to form the conjunctival sac. Also you recall the conjunctiva that is on the eye itself is called bulbar conjunctiva.


MUELLER'S MUSCLE(SMOOTH MUSCLE)
LEVATOR PALPEBRAE SUPERIORIS MUSCLE
SUBCUTANEOUS CONNECTIVE TISSUE
SUBMUSCULAR CONNECTIVE TISSUE
SKIN
PALPEBRAL CONJUNCTIVA
TARSUS
ORBICULARIS OCULI MUSCLE
MEIBOMIAN GLANDS
GLAND OF ZEIS
RIOLAN'S MUSCLE

(Figure 1-3)

Eyebrows

The eyebrows are located on the upper borders of the orbits. The eyebrows consist of a thickened ridge of skin covered with short hairs. This diverts perspiration from the eye.

Accessory Glands

The accessory glands may be divided into three groups, i.e., the meibomian or tarsal glands, the ciliary or sweat glands. (glands of Moll),and various conjunctival glands. The most important of these are the meibomian glands, which are sebaceous glands. The ducts of the meibomian glands open on the edge of the eyelid. The oily substance secreted by the meibomian glands lubricates the lid margins and prevents adhesion of the eyelids. If a meibomian gland gets infected or it's opening gets blocked, the result is a large lump on the eyelid called a chalazion.

Lacrimal Apparatus (See Figure 1-4)

The lacrimal apparatus is made up of seven structures: the lacrimal gland, lacrimal canals, conjunctival sac, puncta, canaliculi, lacrimal sac, and the nasolacrimal duct.

The lacrimal gland is located under the frontal bone at the upper and outer angle of the orbit. It is roughly the size and shape of an almond. Six to 12 ducts lead from the gland to the conjunctival surface of the upper lid. The lacrimal gland secretes just enough tears to keep the eye moist. After passing over the surface of the eyeball, the tears are sucked through the puncta into two tiny canals called canaliculi which convey the tears into the lacrimal sac. The tears then drain slowly into the nose by way of the nasolacrimal duct.

The purpose of the lacrimal secretion (tears) is to keep the eye moist and to help remove foreign bodies, dust, etc. Ordinarily the secretion evaporates or is carried away as fast as it forms; but, under certain conditions, such as when the eye is irritated or during painful emotional states, the secretion of the lacrimal gland exceeds the drainage of the nasolacrimal duct and the tears accumulate in the conjunctival sac, finally overflowing upon the cheeks. We call the overflow of tears epiphora and an under production of tears is called alacrima.

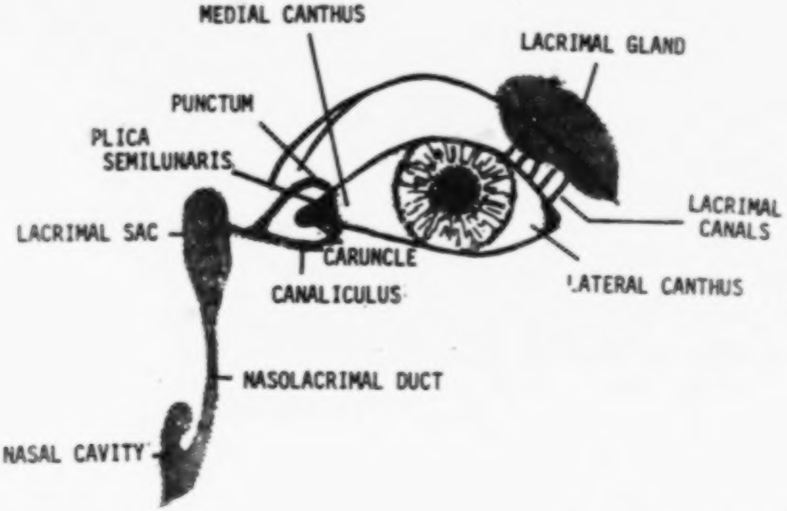


Figure 1-4

THE SCHIRMER TEAR TEST

The Schirmer tear test measures the amount of tears produced by the lacrimal gland. This test will tell you if the eye is being lubricated sufficiently. The test is indicated for patients who have symptoms of dryness, burning, or a sandy or gritty feeling in the eyes. It is also useful in determining whether a patient has a sufficient amount of tears for comfortable contact lens wear.

The test consists of two pieces of filter paper 5mm wide and 35 mm long in a sterile package. One end of the strip is rounded and there is a notch on one side of the paper, 5mm from the end. (Fig. 1-5)

The procedure for the test is simple:

1. Seat the patient comfortably, preferrably with the head against a headrest.

2. Tell the patient what you are going to do, this will relieve apprehension.

3. Bend the rounded end of the filter paper at the notch (about 90^o), while it is still in the package, to make a wick.

4. Cut the package at the end opposite the wick and remove the paper strips.

5. Instruct the patient to look up.

6. Gently pull the lower lid downward.

7. Hook the rounded, bent end of the sterile strip (wick), over the lower eyelid margin nasally. (Be sure not to touch the cornea at this time as this time as this would cause pain and reflex tearing would make the test inaccurate.

8. NOTE THE TIME!!

9. Tell the patient he/she may continue blinking or may close his/her eyes during the test. (Discourage squeezing the eyelids).

10. After five minutes have elapsed, remove the strips and measure the moistened area beginning at the notch. There is a mm scale on the test package. You may also find it helpful to hold the strip up to the light to see the moistened area.

11. Record the measurement in mm. For instance: Schirmer Test OD 18mm
OS 16mm

The standard for most patients is to have a moistened area of at least 15 mm in each eye. As we get older our tear production reduces. Above age 40, 10-15 mm in each eye can be considered normal. A measurement of less than 10mm in any eye should be given careful consideration and is probably indicative of insufficient tear production.

There is a variation of the Schirmer tear test called Schirmer's test number 2. This is exactly the same as the test previously described except that a drop of anesthetic solution is put in the eye before the test. This supposedly eliminates any reflex tearing caused by the paper itself.

When a diagnosis of insufficient tearing is established, the treatment usually consists of placing a drop of artificial tears (methylcellulose) in the eye. There are many brands of artificial tears on the market, most of which are over the counter medications. Of course, a candidate for contact lenses who has insufficient tear production may be advised not to wear contact lenses.

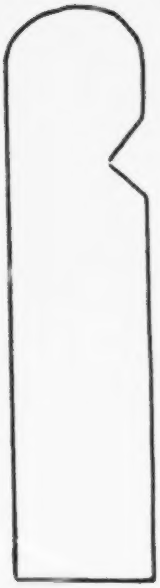


Figure 1-5

EXERCISE III-1b

INSTRUCTIONS:

Answer the following questions in the spaces provided.

1. The primary function of the eyelids is ______________________.

2. The ______________________ muscle closes the eyelids.

3. The upper eyelid is elevated by the ______________________ which is innervated by the ____________ CN.

4. The area where the upper and lower eylids meet on the temporal side is called the ______________.

5. The ______________________ is believed to be a remnant of a third eyelid in lower vertebrates.

6. The primary function of the eyebrows is to ______________________ .

Questions 7 through 13, list the layers of the eyelid from front to back.

7. ______________________

8. ______________________

9. ______________________

10. ______________________

11. ______________________

12. ______________________

13. ______________________

Questions 14 through 20, label the following diagram of the lacrimal apparatus.

14. ______________________

15. ______________________

16. ______________________

17. ______________________

18. ______________________

19. ______________________

20. ______________________

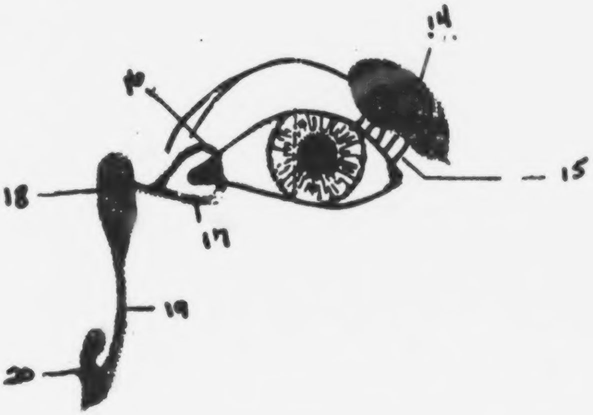


Figure 1-6

Complete the following statements.

21. The normal moistened area on the Schirmer tear test for people over 40 years of age is ______________.

22. The Schirmer tear test is designed to measure ________________________ .

23. The tear test strips should be removed after ____________ minutes.

24. In case the Schirmer scale is lost, what unit of measurement should be used to measure the tears.

THE EXTRINSIC MUSCLES

Movement of either eye is affected by six extraocular or extrinsic ocular muscles which act in coordination with the muscles of the opposite eye. The extraocular muscles should be differentiated from intraocular (intrinsic ocular) muscles located within the eyeball. Remember that the intraocular muscles control pupil size and the focus of the eye, while the extraocular muscles control eye movement, i.e., the direction of gaze.

The extraocular muscles lie within the bony orbit. They are organized, more or less, into a loose umbrella-like bundle among the orbital fat, the orbital blood vessels and nerves. A layer of tissue, Tenon's capsule, surrounds the eyeball. It is attached to the sclera near the limbus and runs posteriorly where it attaches to the optic nerve. The extraocular muscles extend through sleeve-like projections of Tenon's capsule from the walls of the orbit to attachments. This can be seen in Figures 1-7 and 1-8.

The extraocularmuscles may be subdivided under two headings--the recti and the obliques. The recti are:

1. Superior Rectus (S.R.)

2. Inferior Rectus (I.R.)

3. Medial Rectus (M.R.)

4. Lateral Rectus (L.R.)

The obliques are:

1. Superior Oblique (S.O.)

2. Inferior Oblique (I.O.)

A muscle can only perform work by shortening, and pulling whatever is attached to it. The action of an extraocular muscle is then dependent upon the place where the muscle is anchored to the bony orbit (origin) and the effective point of insertion of the muscle into the globe.

The four recti originate from the apex of the orbit, around the optic nerve, and travel forward to insert in front of the equator (Figures 1-7 and 1-8). The superior oblique also originates from this area, but runs through a little circle of cartilage called the trochlear pulley before inserting in the eye just below the superior rectus. The trochlear pulley is located in the superior nasal (up and toward the nose) portion of the bony orbit.

The only extraocular muscle that does not originate from the orbital apex is the inferior oblique. This muscle originates from the floor of the orbit, near the nasal portion of the orbital margin, and inserts in the lateral side of the globe, posterior to the equator.

Study the diagrams in this Study Guide and Workbook, and look at the eye models in class so that you become familiar with the relations of the extraocular muscles to each other, to the globe, and to the orbit. Remember that all recti insert anterior to the equator of the globe and all obliques insert posterior to the equator. This is why the superior oblique may be a depressor and the inferior oblique may be an elevator (in the adducted position).

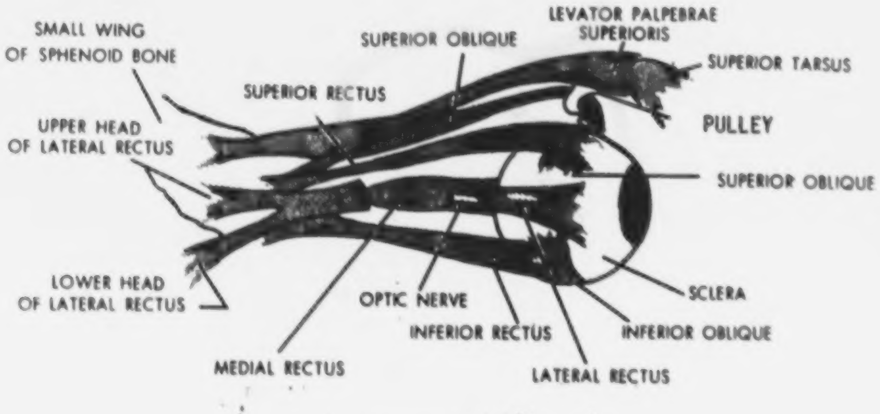


Figure 1-7

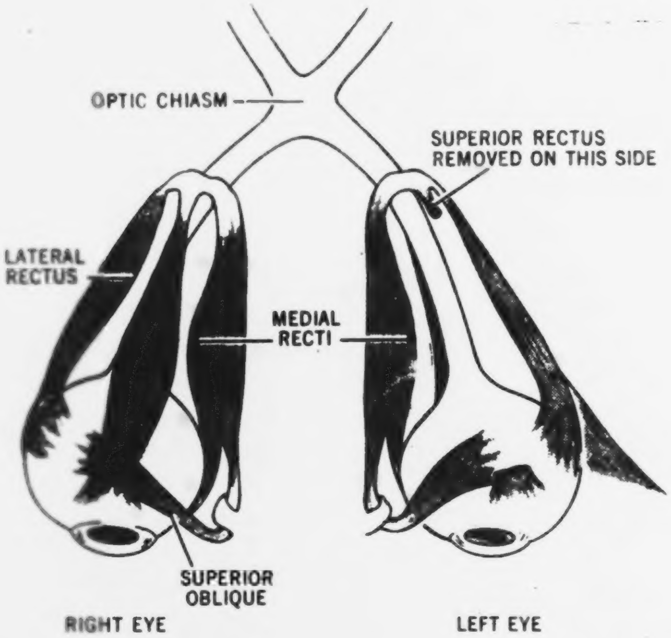


Figure 1- 8

Muscles get their power supply (innervation) from nerves. Before we discuss which nerves innervate which ocular muscles, let's briefly review the human nervous system. The nervous system and the nerves are divided according to function.

The central nervous system (CNS) consists of the brain and spinal cord. The peripheral nervous system (PNS) consists of the nerve trunks which extend from the CNS. These nerve trunks are of three basic types according to their function.

1. Motor (efferent) fibers. These nerves convey impulses from the CNS to the muscles, controlling their contraction.

2. Sensory (afferent) fibers. These nerves carry impulses to the brain, for example, as for sight, hearing, smell, taste, touch, the state of muscle contraction, etc.

3. Mixed fibers. These nerves are a combination of both motor and sensory fibers.

Essentially, all messages to and from the central nervous system travel along the nerve pathways in the peripheral nervous system.

A nerve pathway or nerve train contains several nerve cells (neurons) adjacent to each other (see figure 1-9). Although there are many kinds of nerve cells, most of them have the same basic structure. Most neurons have a cell body, an axon, dendrites, and synapse with the next cell in the nerve pathway. Each of these structures will be explained more fully in the classroom.

Now we are ready to put the nerves and eye muscles together.

Innervation to the superior rectus, medial rectus, inferior rectus, and inferior oblique is by means of the third cranial nerve (oculomotor nerve). The lateral rectus is innervated by the sixth cranial nerve (abducent nerve) and the superior oblique is innervated by the fourth cranial nerve (trochlear nerve). An easy way to remember this is to use the formula: $(LR_6SO_4)_3$ which means that all of the muscles are innervated by the third cranial nerve, except the lateral rectus (VI), and the superior oblique (IV).

The nerves which you have just learned are called motor nerves because they innervate muscles. A little later in the SW, you will learn the sensory nerves of the eye, which include II (optic), V (trigeminal) and VII (facial).

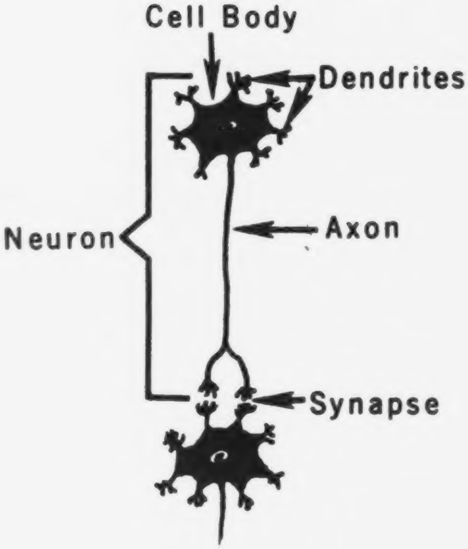

Cell Body
Dendrites
Neuron
Axon
Synapse

Figure 1-9

OCULAR MOTILITY

The six extraocular muscles must work together for you to see a single image. They must move each eye so that the object you are looking at is centered on the fovea. They must coordinate the movements of both eyes so diplopia (double vision) does not occur. When both eyes work together you are able to maintain SBV (single binocular vision). In other words, you can keep the images seen by each eye fused into one image.

Every normal person can experience a phenomenon called physiologic diplopia. It occurs during normal binocular vision and is caused by an object being closer or farther away than the one you are actually looking at. You can demonstrate this by looking at something across the room and holding your finger up approximately twelve inches in front of your face. You'll then see two fingers instead of one.

When you can't maintain SBV and diplopia occurs, the brain can't interpret the two images. When this occurs, the brain will usually ignore the image sent by the deviated eye. This "turning off" of vision is called suppression and can lead to other problems. One of these is amblyopia exanopsia or "lazy eye" which is a condition of reduced vision in a normal healthy eye due to non-use or suppression of vision. You can relate this to muscle degeneration created when your leg is in a cast for a prolonged period of time.

Each muscle has a specific job to do in order to make the eye move. This is called the muscle action and is named after the movement of the eye which it causes. If a muscle turns the eye up, it is called an elevator; if the eye is turned down, the action is depression; if the eye is turned out (temporally) the action is abduction; and if the eye is turned in (nasally) the action is adduction. If the eye is rotated so that the top of the iris seems to move in, while the bottom moves out, the action is called intorsion. If the top goes out and the bottom moves in, the action is extorsion.

Each muscle can perform more than one action. The primary action of a muscle is the main action performed by that muscle when it moves from the primary position (the straightforward position).

A secondary action is an additional action performed by a muscle while is it performing its primary action. For instance, when the eyes are in the primary position (straight ahead), the superior rectus is the main elevator. The primary action of the superior rectus is elevation, but due to the angles of the orbits (Figure 1-8), the superior rectus slightly adducts and intorts the eye at the same time. These are secondary actions.

The primary and secondary actions of the extraocular muscles are listed below in Chart 1-1.

MUSCLE	PRIMARY ACTION	SECONDARY ACTION
Lateral Rectus	Abduction	None
Medial Rectus	Adduction	None
Superior Rectus	Elevation	Adduction and intorsion
Inferior Rectus	Depression	Adduction and extorsion
Superior Oblique	Intorsion	Depression and abduction
Inferior Oblique	Extorsion	Elevation and abduction

Chart 1-1

Whenever two muscles work together to help perform the same action in the same eye, they are called synergists. For example, the superior rectus and inferior oblique of the same eye act together synergistically to elevate the eye. Whenever two muscles act in opposition to each other in the same eye, they are called antagonists. For example, the superior and inferior recti of the same eye are antagonists; i.e., while the superior rectus is acting to elevate the eye, the inferior rectus tends to hold back that action. Sherrington's Law of Reciprocal Innervation states that antagonists never contract equally together; one antagonist contracts while the other relaxes.

Two muscles which perform the same action in opposite eyes are called yoked muscles. For example, the left lateral rectus (LLR) and the right medial rectus, (RMR) are yoked to turn the eyes left. Other yoked pairs are the LSR-RIO, LIR-RSO, RSR-LIO, and RIR-LSO. Hering's Law of the Ocular Movements states that the movements of the two eyes are equal and symmetrical--this is a result of equal innvervation to the paired or yoked muscles.

Controlled movements of the two eyes generally fall into two categories referred to as versions and vergences. A version is a conjugate binocular movement, i.e., both eyes are parallel and are moving together in the same direction--right, left, up, or down. A vergence is a disjunctive binocular movement, i.e., both eyes are converging or diverging. It is normal for your eyes to converge (turn in) when you look at something very close, and it is just as normal for your eyes to diverge back to parallelism later when you gaze at something far away. Convergence and divergence are examples of disjunctive movements of the two eyes.

Anomalies of Ocular Motility

Sometimes a muscular or neural anomaly develops in which the line of sight of one eye fails to intersect the object of fixation. If one eye fixates (looks at) an object, and at the same time it is found that the line of sight of the other eye is directed to the left, right, above, or below the object of regard, the patient is said to have a deviated eye. This deviation is called a HETEROTROPIA (or strabismus or squint).

You should know and understand the following classifications of heterotropia:

ESOTROPIA. One eye is deviated "in" (i.e., toward the nose) relative to the fixating eye.

Note: the synonyms for esotropia are: convergent strabismus, convergent squint, and crossed-eye.

EXOTROPIA. Relative to the fixating eye, the other eye is deviated "out".

Synonyms for exotropia are divergent strabismus, divergent squint, wall-eye.

HYPERTROPIA. Relative to the fixating eye, the remaining eye is deviated "upward".

HYPOTROPIA. Relative to the fixating eye, the remaining eye is deviated "downward".

Esotropia and exotropia are lateral deviations while hypertropia and hypotropia are vertical deviations. It is possible for a patient to have a strabismus made up of both a lateral and a vertical component, e.g., a right hyper-exotropia.

Based on the nature of fixation the above categories of strabismus can be further classified as monocular or alternating:

MONOCULAR STRABISMUS. One eye is always the fixating eye and the other eye is always the deviating eye. Such patients usually have good vision in one eye and poor vision in the other eye. You would normally expect the eye with the poorer vision to be the deviating eye.

ALTERNATING STRABISMUS. These patients have no preference of one eye over the other. They can alternately fixate with either eye.

INTERMITTENT STRABISMUS. These patients can have either monocular or alternating strabismus, but it is only present at times--not constantly. For example, a child has a tendency for his right eye to turn in but it only does so at the end of the day when he is tired. He would have intermittent right esotropia.

There are many other ways of classifying strabismus, but for now the above categories are what you need to know. Test your comprehension at this point by asking yourself to describe a right esotropia. This term should tell you that the patient has a right eye which is deviated in. Because it is a right esotropia,(in other words, the patient does not alternate fixation), the patient prefers to fixate with his left eye. Therefore, it is also very likely that he has better vision with his left eye.

Muscular anomalies are not always manifest (obvious) deviations such as we have described with the heterotropias. There are also latent (hidden) muscle deviations which are only manifest when the eyes are dissociated, or kept from normal binocular vision. One way to interrupt normal binocular vision (dissociate the eyes) is simply to cover one eye with an occluder. If the covered eye then assumes a position of deviation, in relation to the eye not covered, the patient has a latent muscle deviation. Upon removal of the cover (and a return to normal binocular vision) the eye that was deviated while it was behind the cover will almost immediately return to a normal position relative to the other eye. These muscle deviations which occur as a result of dissociation are called HETEROPHORIAS.

Heterophorias are classified according to the position the eyes would assume under conditions of dissociation. However, be careful not to confuse this with the classification of heterotropias which is under manifest conditions. You should know and understand the following classification of heterophoria:

ESOPHORIA. A latent tendency for the lines of sight to deviate inward relative to each other under conditions of dissociation.

EXOPHORIA. A latent tendency for the lines of sight to deviate outward relative to each other under conditions of dissociation.

RIGHT HYPERPHORIA. A latent tendency for the line of sight of the right eye to deviate upward relative to the line of sight of the left eye under conditions of dissociation.

LEFT HYPERPHORIA. A latent tendency for the line of sight of the left eye to deviate upward relative to the line of sight of the right eye under conditions of dissociation.

ORTHOPHORIA. Under conditions of dissociation there is no deviation of the lines of sight one from the other. In other words, both eyes remain directed toward the object of regard even though one eye is dissociated from the other as by an occluder-- there is no latent deviation.

Although some authors define the term "hypophoria", common custom describes any vertical phoria in terms of "hyperphoria". Insofar as the vertical phorias are concerned, it is customary to record a left hypophoria as a right hyperphoria and a right hypophoria as a left hyperphoria. (The same is true in alternating strabismus containing a vertical component--i.e., the vertical component is described in terms of hypertropia rather than hypotropia.

Except for the "hyper" conditions, phorias are not classified according to which eye is affected. In other words, lateral phorias are recorded simply as "esophoria" or "exophoria" or "eso" or exo" with no breakdown as to right or left unless there is also a vertical component present. It is possible for the patient to exhibit both vertical and lateral components--a right hyper-exophoria, for example.

EXERCISE III-1c

INSTRUCTIONS:

Complete the following statements.

1. All of the extrinsic ocular muscles except the ______________________ originate at the orbital apex.

2. All EOM's insert into the ______________________________.

3. The __________________ and ________________ muscles insert behind the equator of the globe.

4. The ______________________ muscle originates at the orbital apex then passes through the trochlear pulley.

INSTRUCTIONS:

List the primary actions of the following extrinsic ocular muscles.

1. Lateral rectus ______________________________

2. Superior rectus ______________________________

3. Medial rectus ______________________________

4. Inferior rectus ______________________________

5. Superior oblique ______________________________

6. Inferior oblique ______________________________

INSTRUCTIONS:

Complete the following statements.

1. The ________________and ____________________ make up the central nervous system.

2. _____________________ nerve fibers are those which carry nerve impulses away from the brain.

3. The ___________________________ is that part of a nerve cell which receives impulses from the previous nerve cell.

4. All of the EOM's are innervated by the third CN except the lateral rectus which is innervated by the ____________________ CN and the superior oblique which is innervated by the _______________CN.

INSTRUCTIONS:

Match the terms on the right with the definitions on the left. The terms may be used more than once or not at all.

_____ 1. A conjugate movement of the 2 eyes. Both eyes remain parallel during the movement.

_____ 2. 2 muscles in the same eye which act in opposition to each other during performance of an action.

_____ 3. 2 muscles in the same eye working together to perform the same action

_____ 4. Muscles which perform the same action in opposite eyes.

_____ 5. A disjunctive movement of the 2 eyes.

_____ 6. Condition in which the lines of signt, in the absence of adequate fusion stimulus, intersect at a given point of reference.

_____ 7. A latent turning inward of the eyes when the eyes are dissociated.

_____ 8. A manifest turning upward of one eye.

_____ 9. A manifest turning outward of one eye.

_____ 10. A latent turning outward of the eyes when the eyes are dissociated.

A. Antagonists
B. Depression
C. Esophoria
D. Esotropia
E. Exotropia
F. Hypertropia
G. Intorsion
H. Orthophoria
I. Suppression
J. Vergence
K. Synergist
L. Version
M. Exophoria
N. Yoked muscles

INSTRUMENTATION AND PROCEDURES USED TO DETECT AND MEASURE ANOMALIES OF OCULAR MOTILITY

Now that you know the names of two common muscular anomalies, the next step is to learn some tests designed to identify and differentiate tropias and phorias. In this section we will discuss such tests--The Diagnostic H, Cover Test, and Worth 4-Dot Test. Other tests will be discussed in unit 2 of this SW, and the AFM 160-17 insert in Block IV.

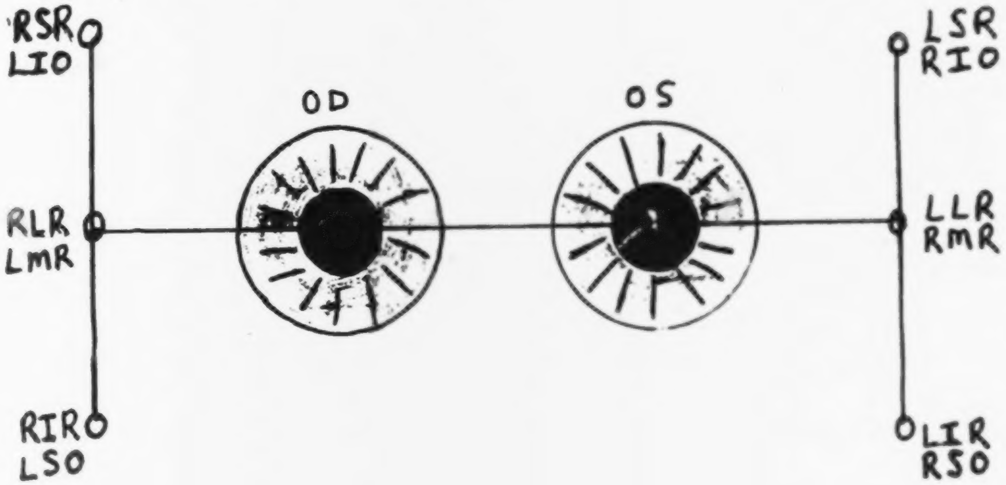


Figure 1-10

Diagnostic H Test

The Diagnostic H Test should be administered in a fairly well-lighted room. Seat the patient facing you and have him fixate a penlight or muscle light held at about a 16" distance in the centerline at eye level. Instruct the patient to fixate on the penlight at all times. Do not allow him to move his head.

While administering this test, observe the position of the reflection of your light from the patient's corneas (corneal reflex) in relation to some point of reference such as the pupil.

Now move the light to your right. If the patient's eyes follow the light (to about 50^0 -60^0) his LLR and RMR are intact.

Now move the light about 50^0 to the left of the centerline. If the patient maintains binocular fixation, his RLR and LMR are intact.

Now elevate the light about 30^0 while the patient is looking right. If both eyes follow this elevation, the LIO and RSR are intact.

Depression of the fixation light about 30^0 while the patient is looking right checks the condition of the LSO and RIR.

Return the light to a position so that the patient is looking far left and up. This checks the LSR and RIO. Depression of the light checks the LIR and RSO.

If the patient can follow the light in all of the above mentioned positions, record results as "EOMS-FULL" (extraocular movements - Full) or "muscle action, full and unrestricted".

If the patient cannot track in one or more positions, record this as "possible paresis (name the muscles)_______________" and notify the doctor.

The following are some examples of some abnormal findings on the diagnostic-H-test. (Figure 1-11)

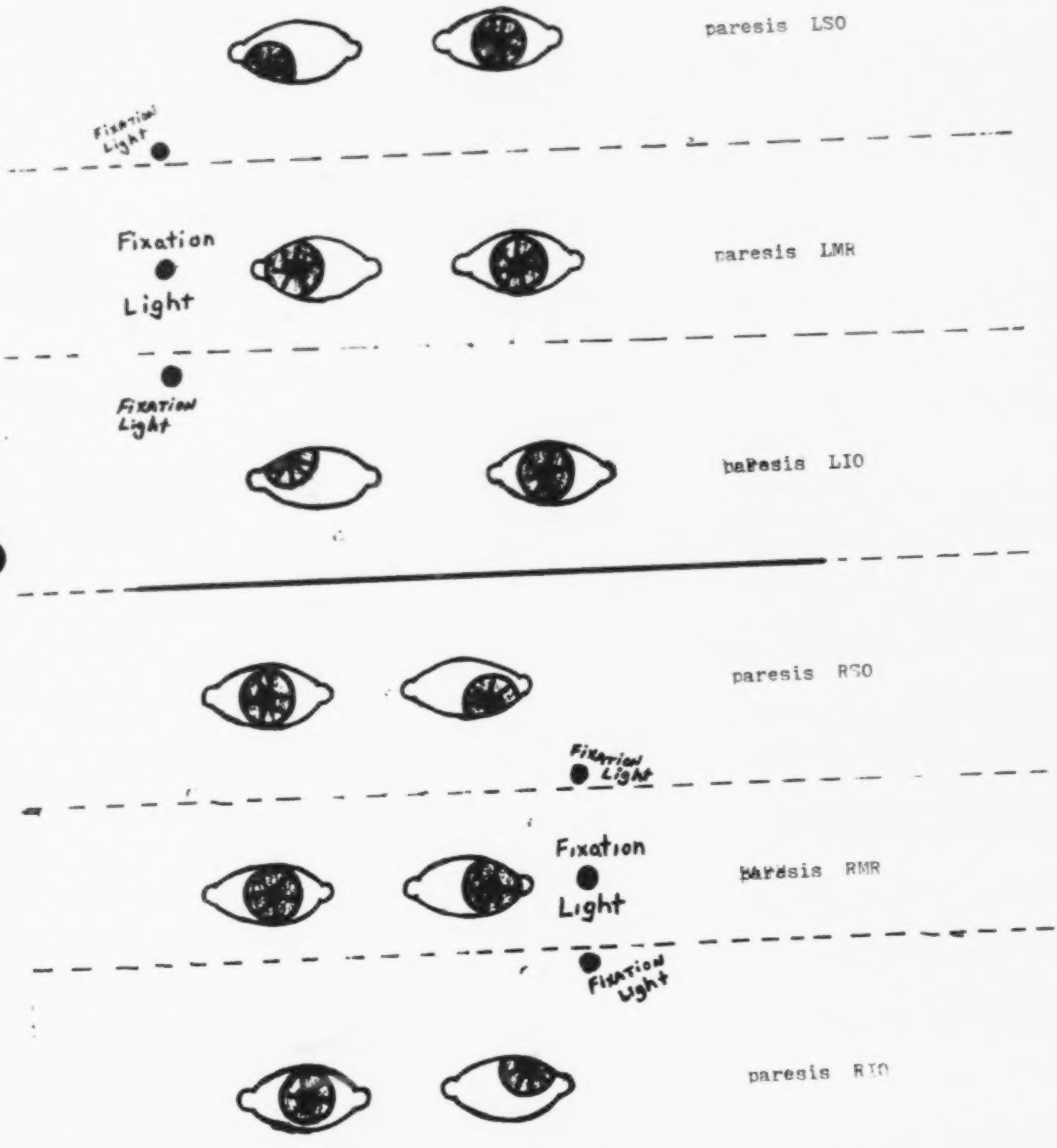

paresis LSO
Fixation Light
Fixation Light
paresis LMR
Fixation Light
paresis LIO
paresis RSO
Fixation Light
Fixation Light
paresis RMR
Fixation Light
paresis RIO

Figure 1-11

Cover Test

The cover test is designed to detect both tropias and phorias, and may be modified to differentiate the two. The cover test is divided into two parts--the alternate cover test and the cover-uncover test. The cover test is performed on essentially all patients seen in the optometry clinic.

The first portion of the test is the alternate cover test at 20'. The patient is instructed to fixate a letter on the wall about 20' away while the examiner covers one eye and then the other with an occluder. If the patient is ortho, no eye movement will be seen when switching the occluder from one eye to the other. If the patient has a muscle imbalance, an eye movement will be noted.

If the eye turns in upon uncovering, it must have turned out when covered (disassociated); this means that the patient is exo. Conversely, if the eye turns out upon uncovering, it was in when disassociated, and the patient is eso. A similar relation exists for vertical imbalances. When you observe an eye that has just been uncovered, you see the compensatory movement.

If a patient is ortho during the alternate cover test, a cover-uncover test does not have to be done. If there is movement during the alternate cover test you note the direction of the imbalance but you don't know at this point whether you are dealing with a phoria or a tropia.

Once the direction of the anomaly has been established, the cover-uncover test is done to determine whether the imbalance is a tropia or a phoria. In this portion of the test, the patient is permitted to fixate binocularly, then one eye is occluded. The occluder is then removed for a few seconds and placed over the other eye. The examiner is to observe the eye which is not being covered. If that eye moves when the opposite eye is covered, the condition is a heterotropia. If the eyes were able to binocularly fixate and no movement occurs between occlusions of both eyes, the condition is a heterophoria.

After you perform the test at 20', you should repeat it at nearpoint, (16 inches) using an accommodative target.

If the alternate cover test reveals no movement, enter "CT: ortho" on item 62, SF 88, or appropriate blocks on DD 741 or local form. If movement is seen, enter type and direction. The amount and character will be entered in item 73, on the SF 88.

Once you have found a muscle anomaly, you must name it correctly, so it can be properly recorded on the exam form. You should remember that lateral phorias are always binocular, so no eye is named. Example: "esophoria," or "exophoria". Vertical phorias are always named for the higher eye: "right hyperphoria"; left hyperphoria".

Tropias need more information for proper identification. A complete record will include the eye, type of tropia, and whether it is constant or otherwise: examples;

1. Right esotropia
2. Left intermittent exotropia
3. Alternating esotropia
4. Left hypotropia

An intermittent tropia is one which is sometimes present as a tropia and sometimes as a phoria. An alternating tropia is one which may affect either eye.

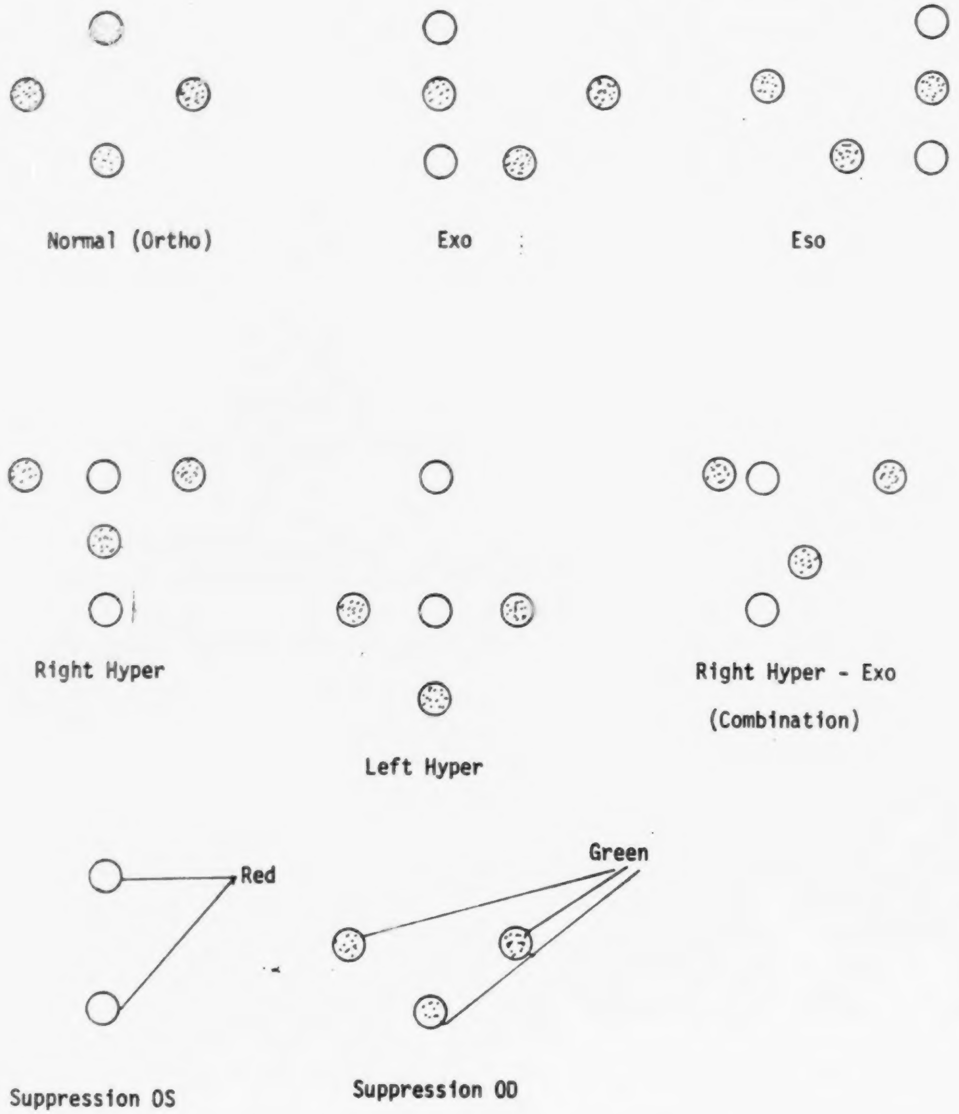
It is extremely important to remember the different nomenclature used to identify muscle anomalies. Do not forget the rules mentioned in the previous paragraphs!

Worth 4-Dot Test

The Worth 4-Dot Test (NSN 6515-00-685-5197 test set, Binocular Vision) may be performed at nearpoint (16 inches) or farpoint using a projectochart. It is designed to detect suppression and/or diplopia.

The test consists of four lighted spots or dots arranged in a baseball-diamond pattern. "Home plate" is white, "first and third bases" are green, and "second base" is red. The patient wears anaglyph glasses (special colored filters - green lens over the left eye, red lens over the right). The right eye can see only the white dot (as red) and the red dot. The left eye sees the white dot (as green) and the two green dots. A person with normal muscle balance and binocular vision would see the four dots just as he would without the glasses, except home plate will appear to be a green/red mixture. This is because the right eye sees it as red and the left as green. If one eye is suppressed, only three or two dots would be seen, and they would be the color of the non-suppressing eye. For example, if the patient reports that he sees 2 red dots only and you are performing the test correctly with the red lens over the right eye, you know that he/she is only seeing out of the right eye and suppressing vision in the left eye. If a high phoria or tropia were present without suppression, five dots would be seen, the pattern depends on the type of diplopia and muscle imbalance. Uncrossed diplopia (green dots seen to the left of the red) indicates an eso condition. Crossed diplopia (green dots seen to the right of the red) indicates an exo condition. Also the hyper eye always sees the lower image. (See figure 1- 12)

The patient is asked to look at the spots, then draw what is seen. The examiner interprets the drawing and records the response on an appropriate form.



Normal (Ortho) Exo Eso

Right Hyper Left Hyper Right Hyper - Exo (Combination)

Suppression OS Suppression OD

Examples of Worth 4-Dot Responses

Figure 1-12

Exercise III-1d

Answer the following questions in the spaces provided.

1. The Cover-Uncover Test can be used to differentiate between ______________________________ and ________________________________.

2. If an eye turns in when covered and then returns to the primary position when uncovered, the condition is ____. (Assume that the other eye did not deviate from the primary position during the test.)

3. List at least eight types of muscle imbalances that can be determined by use of the Cover Test.

4. The Diagnostic H Test is based on the assumption that in certain directions of gaze, one of the ________________________ ________________________ of an eye is more or less isolated from the rest.

5. When administering the Diagnostic H Test, you find that the patient sees double when looking up and to his right, what muscles are suspected? ________________________ ________________________ and the ______________________________. ______________________________.

6. With reference to question 5, if the corneal reflex was centered on the right eye but decentered on the left eye in the up-right direction of gaze, which eye muscle is paretic or paralyzed? ______________ ________________________ ________________________________.

7. During the Worth 4 Dot Test if the patient reports 3 green lights only you would suspect ____________ ________________________________.

8. If the patient reports 5 lights during the Worth 4-Dot Test, you can always figure out what condition exists by knowing that crossed diplopia is an ____________ condition, uncrossed diplopia is an ____________ condition and the hyper eye sees the ________________ image.

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SW J3ABR91235000-III-2
January 1983

ANCILLARY OPTOMETRIC PROCEDURES

This study guide and workbook (SW) is designed to give you basic knowledge in the anatomy and physiology of the visual pathways, measuring pupillary reflexes, measuring central and peripheral fields, instillation of ophthalmic drops, measuring intraocular pressure, measuring blood pressure, ocular signs and symptoms, and contact lens wear and care.

OBJECTIVES

a. Given WS J3ABR91235 000-III-2a, identify the visual and pupillary pathways. With 70% accuracy.

b. Given the necessary materials and an instructor selected patient, perform a pupillary reflex test with no more than one instructor assist.

c. Given the necessary materials and an instructor selected patient, perform visual fields tests with no more than two instructor instructor assists per test.

d. Given WS J3ABR91235 000-III-2d, identify facts about ophthalmodiagnostic medications with 70% accuracy.

e. Given the necessary materials and an instructor selected patient, instill a non-harmful ophthalmic drug with no more than one instructor assist.

f. Given WS J3ABR91235 000-III-2f, describe the procedures for performing schiotz tonometry with 70% accuracy.

g. Given the necessary materials and an instructor selected patient, perform NCT tonometry. with no more than one instructor assist.

h. Given the necessary materials and an instructor selected patient, determine the patient's blood pressure within 8mm Hg of the rate determined by the instructor.

i. Given WS J3ABR91235 000-III-2i, identify signs and symptoms of common ocular referrals with 70% accuracy.

j. Given WS J3ABR91235 000-III-2j, identify characteristics of contact lenses with 70% accuracy.

k. Given WS J3ABR91235 000-III-2k, select information given to patients during contact lens orientation with 70% accuracy.

INTRODUCTION

The primary method of localizing lesions in the visual pathway is by peripheral and central fields examinations. Later in this SW we will discuss the various instruments and procedures check the visual field, but first we should examine the visual pathways.

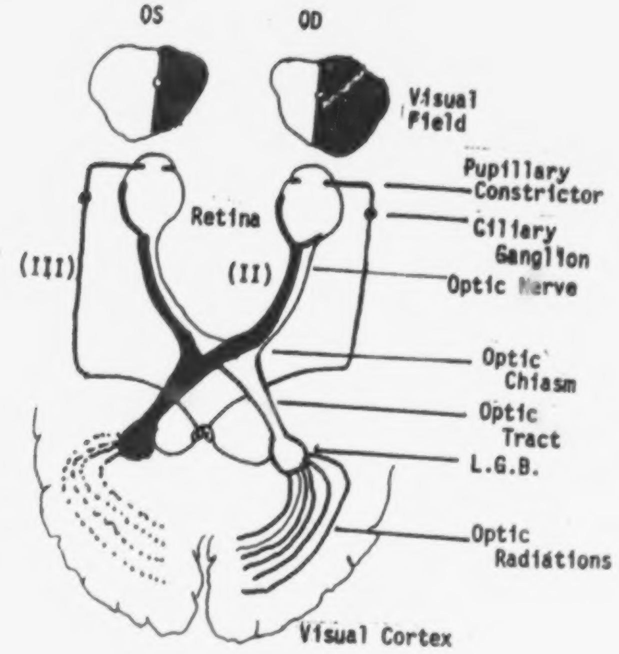
INFORMATION

ANATOMY AND PHYSIOLOGY OF THE VISUAL PATHWAY

The visual pathway is defined as the path taken by nerve impulses between the eye and the brain when the retina is stimulated by light. Although this definition is oversimplified, it gives you the basic idea of what the visual pathway is. We should understand, however, that the brain does not receive a simple copy of the retinal image. Vision is much more complex than that. When the retina of the eye is stimulated by light or by an image, an information-gathering process about the light or the image is begun. The information is organized and coded into nerve impulses, and the coded impulses are then transmitted to the visual cortex of the brain by means of the visual pathway.

The Visual (Afferent) Pathway

The visual pathway consists of seven structures: the retinas, optic nerves, optic chiasm, optic tracts, lateral geniculate bodies, optic radiations, and the visual cortical areas (Figure 2-1). There are three neurons which connect the visual receptors (rods and cones) of the retina to the visual areas located in the occipital lobe of the brain. The first neurone is the retinal bipolar cell which connects the rods or cones to the second neurone, the ganglion cell. The ganglion cell body is also located in the retina, but its axons extends from the retina to the optic nerve, optic chiasm, and through the optic tract to synapse in the lateral geniculate body with the third neurone. From the lateral geniculate body (LGB) the axones of the third neurone pass by way of the optic radiations to the visual cortex.

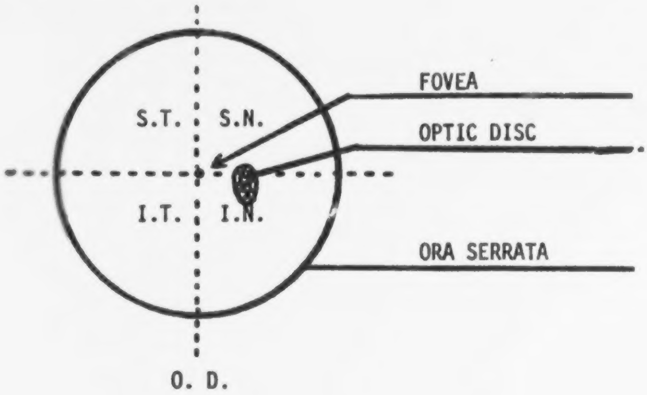

OS
OD
Visual Field
Pupillary Constrictor
Retina
Ciliary Ganglion
(III)
(II)
Optic Nerve
Optic Chiasm
Optic Tract
L.G.B.
Optic Radiations
Visual Cortex

NOTE how the right portions of each visual field are "seen" by the left half of the brain.

Figure 2-1

The Retina

The retina may be anatomically divided into four quadrants with the fovea at the exact center (see Figure 2-2). The optic nerve head is located in the nasal half, and the ora serrata is equivalent to the circumference of the circle. Remember, the fovea "sees" the exact center of your vision, and the peripheral retina (nearer the ora serrata) "sees" the edges of your vision. Since images are inverted and reverted, light striking the superior nasal retina came from the inferior temporal field, and this "opposite" relationship holds true for all quadrants.



Anatomical Division of Right Retina

Figure 2-2

The Optic Nerve (Cranial Nerve II)

The optic nerve consists of ganglion cell axones leaving the retina. These axones leave the retina at a spot called the optic nerve head which contains no receptors; therefore, the optic nerve head corresponds to a blind spot in our visual field. The optic nerve contains ganglion axones from both halves of one retina (Figure 2-1). A lesion here would cause total blindness of one eye ("lesions" means injury).

The Optic Chiasm

At the optic chiasm, the ganglion fibers from each nasal retina cross over to the other side, whereas fibers from the temporal retinas do not; thus the fibers leaving the optic chiasm contain cells from either both left halves of the retinas or both right halves. A lesion here may create a heteronymous hemianopsia called a bitemporal hemianopsia (heteronymous = opposite sided; hemianopsia= half blind; heteronymous hemianopsia means opposite halves of visual field are blind).

The Optic Tracts

Each optic tract contains fibers which represent only one half of the visual field, temporal from one eye and nasal from the other. Figure 2-1 shows how the left optic tract contains fibers which "see" the right visual field. A lesion in this area would create a homonymous hemianopsia (Homonymous = same sided. Homonymous hemianopsia means the same halves of each eye's visual field are blind.).

The Lateral Geniculate Body (LGB)

The lateral geniculate body is a relay station containing synapses to direct an impulse to either the Edinger-Westphal nucleus (for pupillary constriction) or to the optic radiations (for vision).

The Optic Radiations

This area of the brain contains wide-spread visual fibers representing the right or left halves of the visual field. A lesion here usually causes a negative quadrantanopsia (negative = "unseen" by patient; quadrantanopsia = ¼ blind)

The Visual Cortex

Broadmann's areas 17,18, and 19 are the vision areas of the occipital cortex. Lesions here cause many defects - from word blindness (alexia or dyslexia) to quadrantanopsia.

Tied in closely with the visual pathway are return pathways between the lateral geniculate bodies and the iris of each eye. The return pathways are responsible for the function of pupil size during the act of accommodation or when the retina is stimulated by light. The LGB thus acts as a processing center for nerve impulses between the retina and higher levels of the brain.

The Pupillary (Efferent) Pathway

The pupillary reflex tests are objective neurological tests for integrity of the visual system (with exception of the cortical centers). Pupillary reflex tests are of importance in detecting and diagnosing the presence of cranial lesions in or near the visual pathway. It is the responsibility of the 912X5 to be able to differentiate between a normal and abnormal pupillary reflex response.

The pupillary reflexes may be divided into three responses:

1. Direct: pupillary constriction in one eye caused when a light is shined in that eye.

2. Consensual: pupillary constriction in one eye when light is shined in the opposite eye.

3. Accommodative: pupillary constriction as a result of the act of accomodation.

Pathway for the Direct Pupillary Reflex (Refer to Figure 2-1)

The direct response originates in the light-receptive cells of the retina, travels back along the optic nerve, through the semi-decussation (splitting in half) at the optic chiasm, backwards along the optic tract to the LGB (Lateral Geniculate Body). Fibers run from the LGB to the Pretectal Nucleus and then to the homolateral (same-sided) III Nerve (Edinger-Westphal) Nucleus. Parasympathetic fibers run along with the III Nerve to the Ciliary Ganglion where they extend forward to the pupillary sphincters, causing the pupil of the stimulated eye to constrict.

Pathway for the Consensual Pupillary Reflex (See Figure 2-1)

The consensual pupillary reflex follows a similar afferent (to the brain) pathway as the direct reflex. Light entering one eye stimulates that retina, and the signal travels backwards along the optic nerve, optic chiasm, optic tract to the LGB. After synapse in the LGB, fibers run to the pretectal nucleus and then to the contralateral (opposite side) III nerve (Edinger-Westphal) nucleus, causing the contralateral pupil to constrict.

Pathway for the Accommodative Pupillary Reflex (See Figure 2-1)

The third pupillary reflex is initiated by an accommodative stimulus (usually a blur). The impulse travels from the III Nerve (Edinger-Westphal) nucleus, following parasympathetic fibers along the III Nerve. These fibers eventually reach the ciliary ganglia and the pupillary sphincters of each eye. When an individual looks at something at nearpoint, three things happen. The eyes converge, they accommodate (focus at nearpoint), and the pupils constrict.

The neurologist, knowing the location of the various nerves which mediate the pupillary reflex, can effectively localize the position of various lesions which may affect these pathways.

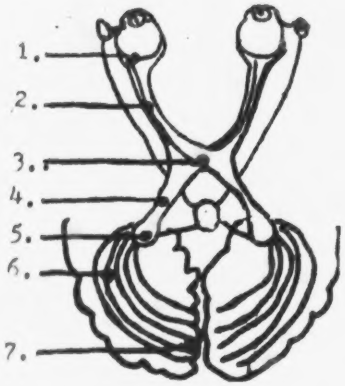
EXERCISE III-2a

PART I- Visual Pathway

INSTRUCTIONS

Answer the following questions.

Questions 1 through 7, label the following diagram.



1. ______________________________
2. ______________________________
3. ______________________________
4. ______________________________
5. ______________________________
6. ______________________________
7. ______________________________

8. The superior nasal retina sees objects in the ______________ field of vision.

9. Visual interpretation takes place in the ________________.

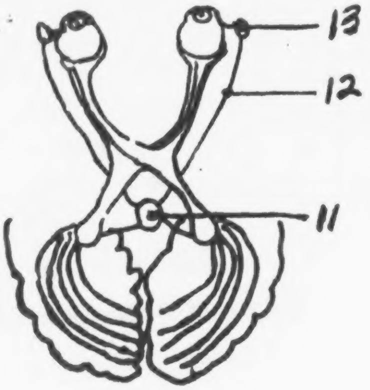
10. Nasal fibers from the right retina end up on the ____________ side of the brain.

PART II - Pupillary Pathways

INSTRUCTIONS

Answer the following questions in the space provided.

Questions 11 through 13. Label the following diagram.



11. ______________________________
12. ______________________________
13. ______________________________

14. The muscle which controls pupillary constriction when the pupillary pathway is stimualted is the ____________________.

PUPILLARY REFLEX TESTS

Test for Direct Pupillary Reflex

The optometric technician should know how to determine and record the pupillary reflex in the proper manner. In eliciting the direct reflex, room lighting should be even. Briefly explain to the patient what you are going to do. While you are doing this you can be observing his/her pupils to see if they are round and equal in size. The examiner will then shield the eye not being tested and will shine a penlight held 6"-8" away into the eye being tested. That pupil should constrict markedly. After noting the rate and symmetry of constriction, the examiner should turn the light off. The pupil should dilate or expand almost immediately. This test is then repeated for the opposite eye.

Test for Consensual Pupillary Reflex

In performing the test for determination of the consensual reflex, the procedure is similar. Again, room lighting should be even. One eye should be shielded from the penlight, but not from the examiner's view. The examiner then shines his penlight into the eye which is not shielded while observing the eye which is shielded. The pupil of the shielded eye should constrict slightly when light is shone into the non-shielded eye. After determining the reflex for one eye, the process should be repeated for the other eye. With practice, both the direct and consensual reflexes can be elicited, observed and recorded at the same time.

Test for Accommodative Pupillary Reflex

The accommodative or nearpoint reflex is again tested in an evenly lighted room. Both eyes are open for this test. The patient is instructed to look from an object located at farpoint to an object located at nearpoint. The pupils should constrict when the patient looks up close. If the nearpoint object consists of fine letters, and if this object is gradually brought closer to the eyes, both pupils should constrict a greater amount as the target is brought closer. (Small letters glued on a tongue depressor make an excellent accommodative target for this test.)

When observing the pupillary reflexes, the constriction of the pupils should be balanced. In the direct response, each pupil should constrict at the same speed, should remain round, and should start and stop with the pupil sizes equal. There should also be an equality in the consensual pupillary reflex. When observing the accommodative reflex, both pupils should constrict equally and simultaneously.

Recording the Pupillary Reflex Tests

The pupillary reflex tests may be recorded on SF 88 (Item 26) as PERRLA (Pupils are Equal in size, Round, and React to Light and Accommodation) if the responses are normal. If the responses are abnormal, record the abnormality and notify the doctor, i.e. PERRL (Pupils Equal, Round and React to Light-but not to accommodation.) or PRRLA (Pupils Round and React to Light and Accommodation but OD is larger than OS). The same method may be used on any local form used in the clinic.

EXERCISE III-2b

Answer the following questions in the spaces provided.

1. List the three types of pupillary reflexes.

2. What abbreviation is used to indicate normal pupillary reflexes? ______________________________.

3. When you are testing the consensual pupillary reflex in the right eye you shine the light in the ______________________________ eye, whereas when testing the direct reflex for the right eye you shine the light in the ______________________________ eye.

THE VISUAL FIELD

The ability to see and identify an object depends in part upon the region of the retina which is stimulated by the image of an object, and the continuity of the neural pathways which connect the retina to the visual centers located in the occipital area of the brain. Any lesion in or near these visual pathways causes a decrease or absence of vision in that portion of the visual field which is transmitted by the affected pathway. One of the responsibilities of the optometry technician is to measure the extent of the visual field.

Definition

The term "visual field" as used here, is defined as that part of space that can be seen when the head and eyes are motionless. The visual field in normal two-eyed vision is the binocular field. The field of a single eye is the monocular or uniocular field.

Positions in the Visual Field

When a person is looking directly at a point, he is using his foveal or central vision. He/she is said to be fixating that point, and the point may be considered a fixation point. The fixation point lies on the visual axis or line of sight and this point and any other object on the visual axis appears at the exact center of the visual field.

When you talk about the central visual field you are talking about the area twenty-five to thirty degrees (25°-30°) out from the visual axis. When you talk about the peripheral field, this is from thirty degrees (30°) to the outer limits of the visual field.

The direction from the center of a visual field is given as superior (up), normally approximately fifty-two degrees (52°); inferior (down), normally approximately seventy degrees (70°); nasal (toward the nose), normally approximately sixty degrees (60°); and temporal (away from the nose), approximately ninety degrees (90°) in the normal patient. A form field is done with a white target, and a color field is done with different colored targets. In this course we will do only form fields.

The terms nasal and temporal are also used to describe positions on the retina of the eye. The temporal retina is the side toward the temple, and the nasal retina is the side toward the nose. Note, however, that an object in the nasal field will be imaged on the temporal retina, and an object in the temporal field will be imaged on the nasal retina because light rays cross the visual axis.

There are variables in the target that can affect the size of the field. First is the target color. The target can be white, red, green or blue. The patient will see the white target before the red, green or blue one. The second variable is target size. A larger target will be seen sooner than a smaller target. The size of the target is designated by its diameter in millimeters. The last variable is target illumination or brightness. This refers to the amount of light radiating from or falling on the test target. It is usually measured in foot candles (FC).

When recording the test target information, always indicate the color, size and illumination, i.e.
3 mm WTO 7 FC
White Test Object Foot Candles

Another term related to visual fields is isopter. This is a contour line representing the limits of retinal sensitivity to a specific test target. (See Figure 2-3) The larger the target-the larger the isopter; a brighter target produces a larger isopter: and a white target will produce a larger isopter.

Relationship of Visual Pathway Structures to the Visual Fields

RETINA. As has been noted previously, the retina consists of 10 layers. The sensory cells in the retina are called rods and cones, depending on their shape and function. Light entering one side of the eye is refracted to the opposite side of the retina. In the same manner, if a defect is located in the temporal retina or any of the nerves supplying the temporal retina, the image of this defect or the result of this defect will be projected to the nasal visual field. (See Figure 2-4)

Visual performance varies with the location of the image on the retina, and hence with the location of the target in the visual field. Therefore, in measuring certain visual functions. the target being used for the test must be placed a known distance form the visual axis.

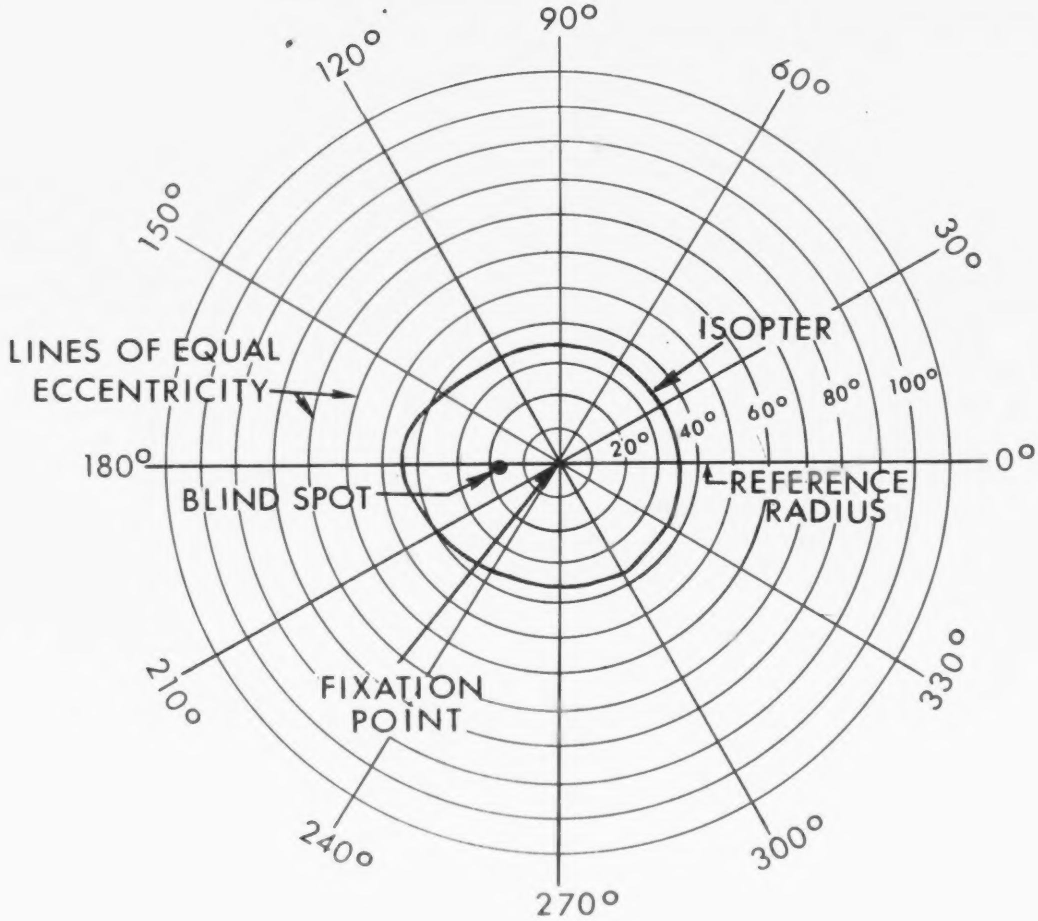

90°
120°
60°
150°
30°
ISOPTER
LINES OF EQUAL ECCENTRICITY
20°
40°
60°
80°
100°
180°
0°
BLIND SPOT
REFERENCE RADIUS
210°
330°
FIXATION POINT
240°
300°
270°

Figure 2-3

When tests of visual performance in various parts of the visual field are made, it is usually found that the ability to perform a certain task--the ability to see a certain sized target (visual acuity)--decreases with distance from the center of the visual field. If all the points at which a minimum or threshold level of performance is attained are plotted on a chart of the visual field, they form a ring (usually rather irregular) around the center of vision. If points are similarly plotted for successively higher levels of performance the result is a series of roughly concentric rings. For visual acuity, the ability to discern detail, such lines of equal performance are called isopters. (See Figure 2-3)

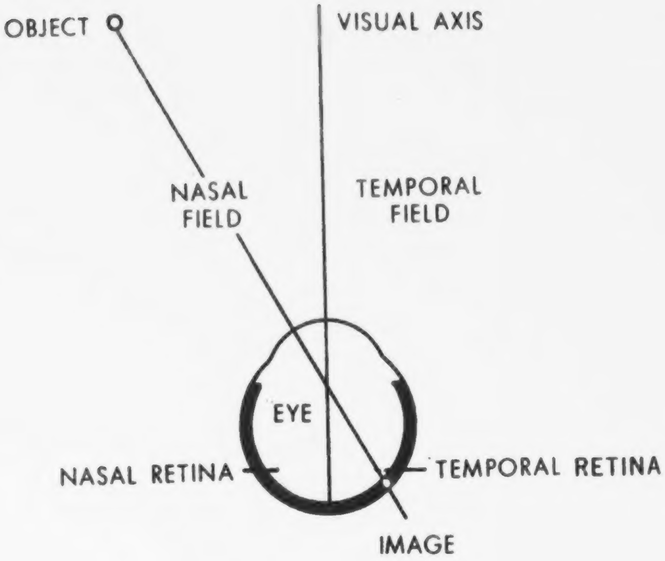


Figure 2-4

As explained in the anatomy of the retina, the optic disc contains no receptive cells, therefore no light or vision is transmitted in the area of the optic disc. This scotoma (blind spot) is called the physiological scotoma. A scotoma caused by disease or injury is a pathological scotoma.

Since the optic disc is located in the nasal portion of the retina, the blind spot or physiological scotoma will be located in the temporal visual field. Usually a lesion affecting the retina causes a positive scotoma (black blind spot), and a lesion affecting the posterior portions of the visual pathway cause a negative scotoma (absence of vision). The physiological scotoma, however, is a negative scotoma. The presence of the blind spot can be demonstrated by closing your left eye and looking at the cross in Figure 2-5. By slowly moving the SW from arms length to an area about a foot from your eyes, you will notice that the circle will disappear. This is due to the fact that the image of the circle falls on the blind spot (optic nerve head), and therefore cannot be seen. If you were to close your left eye and look at the circle and not be able to see it, it would be a central scotoma. This would be caused by a lesion encompassing the area of central vision. (macula).

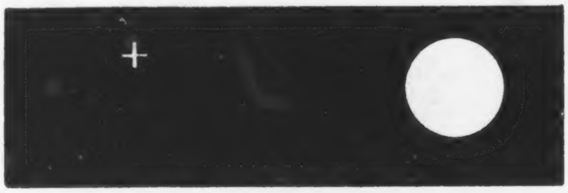


Figure 2-5

THE OPTIC NERVE. (Figure 2-5). The optic nerve is composed of bundles of axones of ganglion cells leaving the eye and entering the brain. It is approximately 5 cm long. The general topographical relationships are upheld in the arrangement of the nerve fibers in the optic nerve. This topographical arrangement is maintained fairly consistently throughout the visual system.

THE OPTIC CHIASM. (Figure 2-1). At the optic chiasm, the qanglion cell axones undergo a semi-decussation or semi-splitting. Fibers from the nasal retina (temporal visual field) cross over to the opposite side of the brain.

OPTIC TRACTS. (Figure 2-1). Extending further into the brain from the optic chiasm are continuations of the ganglion cells, each side mediating either the right or left visual field. These continuations are called the optic tracts.

THE LATERAL GENICULATE BODY (LGB). (Figure 2-1). The optic tracts synapse deep in the brain at the LGBs. This is the main relay station for visual sensations. The pupillary reflex pathway branches from the main bundle of visual fibers at this point.

OPTIC RADIATIONS. (Figure 2-1). Extending back from the LGBs are the third order neurons called optic radiations. These neurons connect the LGB to the visual cortex.

VISUAL CORTEX. (Figure 2-1). The visual area of the brain is located in the region of the occipital lobes (Broadmann's areas 17, 18 and 19). This portion of the brain is not only associated with seeing, but with remembering things seen in the past, recognizing things seen at the present time, and associating memories of things seen with things being seen.

As you can see from the above, a lesion affecting any of the nerve fibers within the seven structures along the visual pathway would produce a defect in all or a portion of the visual field; and, of course, the shape or extent of the visual field defect would depend on the size and location of the lesion within the visual pathway. Knowing the nerve fiber distribution along the pathway and by careful analysis of visual field plottings, it is often possible for the doctor to closely approximate the location of a lesion within the brain.

Visual Field Defects

We have already defined positive and negative scotoma and physiological scotoma. Scotomas are blind areas (or areas of reduced vision) within the visual field which do not extend to the periphery of the field. Usually the field around a scotoma is normal.

Defects of the limits of the field may occur as a constriction of all the field, constriction in one meridian only (field distortion), or constriction in a segment (sector defect), or a quadrant (quadrantanopsia), or half of the field (hemianopsia).

There are two catagories of visual field tests, screening and diagnostic. A screening test is a rapid simple test to determine the presence or absence of a visual field anomaly. A diagnostic test is a sophisticated test to detect and accurately measure any visual field defect.

PERIPHERAL VISUAL FIELD METHODS

There are many methods of determining the extent of the visual fields, the first and easiest to administer is the confrontation test. This is a screening test for the peripheral field. The confrontation test is based upon a comparison of the monocular fields of vision of examiner and examinee, which, assuming their facial configuration to be alike the fields should be similar. The examiner will face the examinee at a distance of 2 feet and will insure their heads are on the same horizontal level. Each holds his head normally erect. The examinees' left eye is occluded and his right eye is fixated upon the examiner's left eye. The latter closes his right eye and fixes his left upon the examinee's open eye. This fixation is continued throughout the test of the examinee's right eye. The examiner holds a plain white 1 cm sphere on a wire handle overhead and in a plane midway between the two. He lowers the sphere keeping his hand out of the way, until it is seen by the examinee. Assuming similar brow configuration, the examiner and the examinee should see the sphere simultaneously. The superotemporal superonasal, nasal, inferonasal, and inferior limits of the field of vision are similarly compared. To estimate the examinee's temporal and inferotemporal limits of vision, the sphere is held behind the plane of the examinee's eye and brought forward until visible; in these meridians the visual field normally extends to 90° or more. A similar technique is used to test the left eye.

If on the confrontation test the field of vision appears to be constricted to a degree not attributable to prominent nose or brow, or if for any other reason the examiner suspects a visual field defect, a more exact (diagnostic) perimetric study is made, employing the perimeter.

The average visual field for form is approximately 90° temporal, 62° superotemporal, 52° superior, 55° superonasal, 60° nasal, 55° inferonasal, 70° inferior, and 85° inferotemporal.

The Perimeter—(Diagnostic test) (Figure 2-6)

The first perimeter was built in 1857 by Aubert and Forster. Almost all the changes which have taken place since then have been improvements in illumination and automation. The basic technique remains the same. There are several types of perimeters in use today, hand or portable perimeters, Ferree-Rand and Brombach perimeters, arc projection perimeters, and hemispherical projection perimeter. One perimeter used in the USAF is the Brombach Perimeter. (Perimeter, Opthalmological, NSN 6515003550650; Chart, recording, perimeter NSN 6515003550680 (right) and 651500355670 (left). It resembles an arc with the patient's eye as its center. An adjustable light source is provided to illuminate the arc equally at all points. A head and chin rest is provided to maintain proper positioning of the patient's head. The perimeter is designed to examine peripheral visual fields, but a campimeter attachment may be used to test central fields. The radius of the arc is 33 cm, this is equal to the test distance from the patient's eye. Normally, 7 Ft-C of illumination will be used with this instrument but this may vary depending on the doctor's orders.

The technique of examining visual fields with the perimeter is as follows:

1. Complete identification data on perimetry record chart to include: name, rank, ssan, telephone, and age. Note that there are two charts, one for each eye. Don't forget to include test target data; color (white), size (3 mm) and illumination (7 FC) and the date of the examination.

2. Place right chart in clip provided on back of perimeter, with arc in horizontal position.

3. Occlude patient's left eye with NSN 6515003670420 Shield, Eye, Surgical, Plastic. This test is done with the spectacles removed.

4. Seat patient comfortably in front of perimeter and place his head in the left side of the chin rest.

5. Instruct patient to observe yellow fixation point at all times. He should not move his eyes from the fixation point. The examiner will insure this by observing the patient's eyes during the examination.

6. While observing the fixation point, the patient should indicate when he becomes aware of the test object in his peripheral field. The test object should be shown to the patient at this time. Usually a signal system is arranged so that the patient does not speak during the examination (one rap with a coin on the perimeter table indicates appearance of the test object, while two raps indicate its disappearance).

7. Demonstrate the movement of the test object from the periphery to the central area.

8. To test the peripheral visual fields of the patient, place the arc in the vertical position, and slowly move the test object from the extreme superior region toward fixation, making sure to keep your hands and arms behind the arc so the patient cannot see them. Mentally note the position where the patient reports visibility of the object. Continue moving the object toward fixation to detect any scotoma. Mark chart with a dot at the position which patient reported detection of test object.

9. After the superior field has been investigated, move the test object to the extreme inferior meridian and test the inferior field, marking the chart as before.

10. Unlock the arc and rotate it to the 45°-225° position (as measured from the examiner's right). Lock arc.

11. Plot the superior temporal and inferior nasal fields in the same manner as you plotted the horizontal fields.

12. Unlock arc and rotate it to the horizontal position.

13. Plot the temporal and nasal fields.

14. Unlock arc and rotate it to the 135° -315° position.

15. Plot the superior nasal and inferior temporal fields.

16. Remove the right chart and replace it with the left.

17. Move occluder to patient's right eye.

18. Position patient's chin in right half of chinrest.

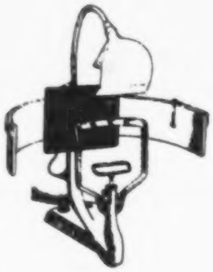
19. Repeat steps 8 through 14, testing the patient's left eye.

20. When test is completed, turn instrument off, remove occluder and charts.

21. Before presenting the charts to the doctor outline the peripheral visual fields of each eye by connecting the dots with straight lines. These lines are called ISOPTERS, and represent the threshhold of vision for the size and color target used. Sign each exam form, and indicate patient's ability to respond.

22. Attach the perimeter charts to the basic eye examination form used in your clinic (or to the referral form, if used), and present them to the doctor.

The perimeter should be kept clean at all times. The dust cover should be used when the perimeter is not in use.

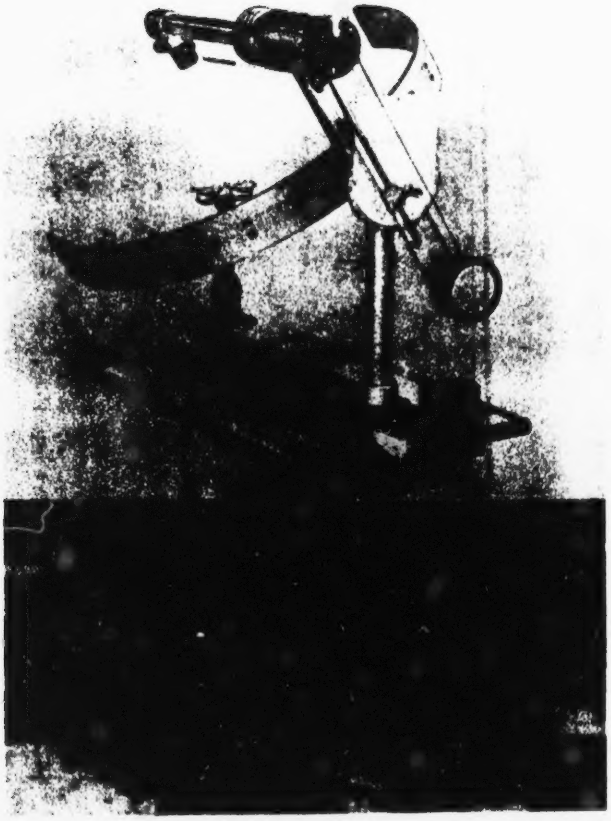


BROMBACH

Figure 2-6

The Aimark Perimeter (B&L) (Figure 2-7)

Another perimeter frequently used in A.F. eye clinics is the Aimark Projection Perimeter manufactured by Bausch & Lomb. This instrument is very similar to the older, Brombach type. Its primary difference is its classification as a projection type apparatus. The Aimark utilizes a projected light test target that may be varied in size and intensity. It also uses a light as a fixation target. The target test object is moved across the center of the arc using a control knob on the examiner side of the perimeter. The target is moved from non-seen areas to seen areas in all 8 cardinal positions as performed on the Brombach. Recording is done by pressing a marker button against the record chart each time the patient gives a positive response. One record chart may be used to record the peripheral field limits of each eye by utilizing different color pens to trace the isopters. Since the Aimark has its own light source, room lights should be off or very dim for testing. The standard test will utilize the 3mm white test object at the highest intensity.



The Aimark (B&L) Perimeter

Figure 2-7

CENTRAL VISUAL FIELD METHODS

The Harrington-Flocks Tachistoscope (Screening Test) (Figure 2-8)

The Harrington-Flocks tachistoscope (NSN 6515005620444; Tachistoscope, Visual Field Test) is a rapid simple screening test for relatively prominent visual field defects. This instrument consists of a series of large test cards printed with fluorescent ink, and a stand with chin rest, card holder and UV light source. Each test card has a series of different patterns of dots which are made visible only under ultraviolet radiation, and a black spot used as a fixation point. The UV lamp may be left on for demonstration purposes or flashed in 1/4-second bursts for testing. Room illumination should be 5 Ft-C. Central fields (25°) are tested.

Tests procedures are as follows:

1. Complete identification data on record chart. One chart is to be used for both eyes.

2. Seat patient comfortably in chair or on stool, and place his chin in the chinrest. Turn toggle switch on. Explain to the patient what you are going to do.

3. Occlude patient's left eye.

4. Instruct patient to observe black fixation dot at all times. Tell him that the test consists of observing the white card and reporting the number of dots that he sees. Demonstrate, leaving the light on for a few seconds.

5. Expose second test card and depress flasher button. The patient should report seeing three dots. If he reports seeing the cross, move his head forward or backward, flashing after each adjustment until the cross disappears. (This cross should fall within the physiological scotoma).

6. Change to third card and flash light. Continue changing cards and flashing the light until the patient makes an error. If an error is made (i.e., patient reports three dots when there are four, or reports visibility of small crosses, or does not report visibility of large crosses) flash the light once more. If the error is repeated, have the patient indicate or describe what he saw. Cross out the "unseen" dot on the composite test chart. (Figure 2-9

7. Following steps 5 & 6 show patient cards 1-9

8. Show the patient the Amsler grid on the last card. Have the patient fixate on the dot in the center of the grid. If the patient reports any distortion of the grid have him/her draw what he/she saw on the amsler grid score sheet. Metamorphopsia (distorted vision).

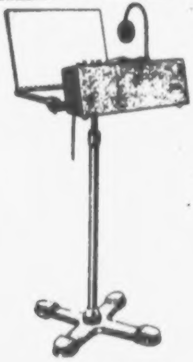
9. Change occluder to right eye and repeat steps 5 and 6 on cards 11-20, reminding the patient to maintain fixation on the black dot.

10. Repeat step #8.

11. If any dots are not seen, a further investigation with the aid of the tangent screen is indicated.

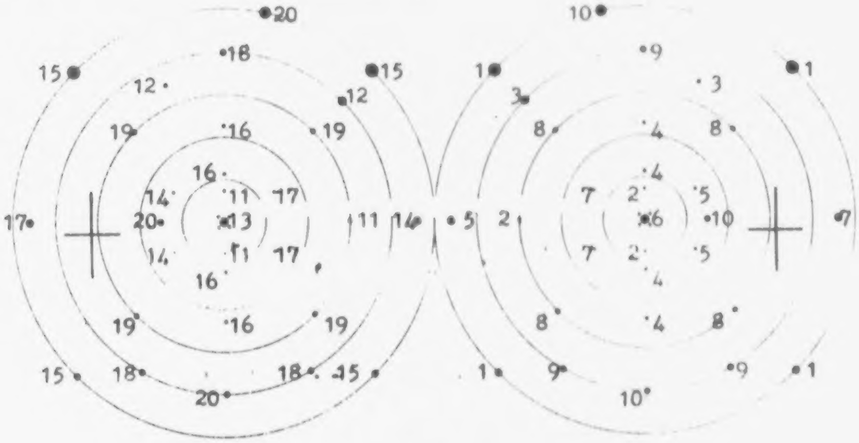
12. Attach composite record chart to referral or basic form and submit to doctor, after signing and dating it.

Figure 2-8 below illustrates the card/dot position that are used in the Harrington-Flocks Tachistoscope test.



Harrington-Flocks

Figure 2-8



L.E. SERIES III R.E.

Figure 2- 9

The Tangent Screen (Diagnostic Test)

The tangent screen consists of a dull black felt cloth, usually about 2 meters square, either fixed to the wall or suspended from rollers (NSN 6515003610690, Tangent Screen, Folding; NSN 6515003810700, Tangent Screen, Roller). A white button is affixed to the center of the screen as a fixation point. The tangent screen is used to detect abnormalities in the central visual field (up to about 30°). Test distance is either 1 or 2 meters. Markings on the tangent screen include circles every 5° (for 1M test distance) and radial lines every 15°. The lines and circles help to localize the test object when recording on the tangent screen chart (usually locally reproduced). The blind spot is also indicated on most tangent screens.

Test procedure is as follows:

1. Complete identification data on tangent screen chart. Indicate which eye is being tested. Since the tangent screen tests central visual fields, the visual acuity should be recorded. The test distance (usually 1M), test object color (usually white), size of test object (usually 2 mm), illumination (usually about 10 Ft-C) and level of patient cooperation are also recorded. The patient should have any errors of refraction corrected for the test distance.

2. Seat patient on stool so that fixation point and eyes are on the same horizontal plane. A 1 M thread attached to the tangent screen will facilitate positioning.

3. Occlude the patient's (poorer eye if there is a difference in vision) (left eye if vision is equal) with plastic shield; spectacles may be worn if necessary.

4. Instruct patient to observe fixation button at all times. Tell him that you will move a white pin (show him the target) around in his field of view, and that he is to report appearance and/or disappearance of the pin (a signal system may be used). The examiner should insure that the patient does not move his eyes from the fixation spot.

5. Demonstrate the appearance and disappearance of the target by slowly passing it through the blind spot. Reassure patient that disappearance of the target is normal. Repeat demonstration until you are assured that patient can accurately report disappearance and appearance of target.

6. Begin testing the patient by measuring the blind spot, always moving the target from a nonseeing area to a seeing one. Insert a black-headed maptack or pin at the points where the patient reports visibility of the test object. Test eight meridians to outline blind spot. Constantly observe the patient's eye to insure fixation during the test.

7. Test remainder of field by moving test target inwards from periphery along the radial lines. Insert a maptack where the patient can first see the test object. Continue this for all eight meridians. Next explore the area around the fixation point out to about 20°, and then survey the rest of the field to rule out any other blind areas.

8. Transfer the finding from the tangent screen to the record chart.

9. Change the occluder to the patient's right eye.

10. Repeat steps 5 through 8.

11. Connect all dots indicating equal isopters, and all dots outlining physiological blind spot or other blind areas.

12. Present the chart to the doctor after dating and signing it.

The Auto-Plot Tangent Screen (Diagnostic Test) (Figure 2-10)

The Auto-Plot tangent screen is a recently stock-listed automated method of testing central fields. It has a range of about 27°, which is equivalent to a 1 - M tangent screen. Components include a chin rest, alignment device, target projection system and field recording system. Various sizes as well as various color test targets may be presented. The test target is opto-mechanically connected to the recording cycle.

Test procedure is as follows:

1. Complete identification data on record chart. One chart may be used for both eyes if the respective isopters are properly annotated. Insert chart in instrument .

2. Explain to the patient what you are going to do.

3. Occlude patient's left eye, spectacles may be worn if necessary.

4. Seat patient comfortably and place his chin in the chinrest. Raise the eye alignment ring and adjust the chin height and fixation spot so the spot is visible in the center of the ring. The ring should be 38 inches from the screen.

Turn instrument ON. Flip alignment ring down.

5. Instruct the patient to observe the "doughnut" or cross-shaped fixation target at all times. Instruct him to signal when the test spot of light disappears. Demonstrate this disappearance by moving the test spot into the blind spot or by pressing the flicker switch.

6. Arrange a response system with the patient, i.e., tapping on the table.

7. Outline the blind spot in the same manner as with the tangent screen. Record your findings by pressing the pencil marking device onto the record chart at the appropriate places. Remember to turn the test spot off (press the flicker button) while marking the chart.

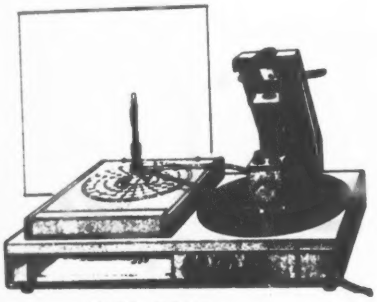
8. Plot the limits of the central field and the pie-shaped intermediate areas as on a tangent screen.

9. Investigate any scotoma as you would using the tangent screen. Change occluder to the right eye and perform steps 4 thru 7 again. Use either a different chart or a different color marking pencil to delineate the fields.

10. Connect all dots indicating equal isopters.

11. Connect all dots outlining physiologic blind spot or any other blind areas.

12. Sign and date the chart, attach it to the referral or basic form, and submit it to the doctor.



AUTO-PLOT

Figure 2-10

AMSLER GRID

The amsler grid chart is used to detect abnormalities in the central 10-15 degrees of the field of vision (10 degrees surrounding the point of fixation). (Figure 2-11) It is a method of getting an idea of the quality of the function of the macula out of its immediate surrounding area.

The basic Amsler Chart consists of a grid that resembles the graph paper you used in school except that the lines are white and are on a dull black background. The squares on the chart are 5mm in size and are designed to subtend an angle of 1 degree when the chart is held 30cm from the eye. In the center of the chart is a white dot that serves as a fixation point. There are 6 other variations of the basic Amsler Grid Chart some of which will be discussed later.

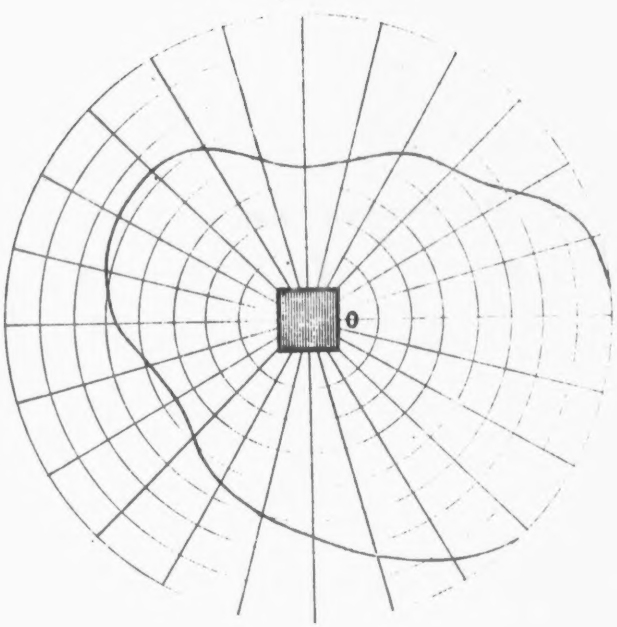


Figure 2- 11

Test procedures are as follows:

1. Explain what you are going to do.

2. Seat the patient comfortably.

3. Have the patient's near prescription in place.

4. Occlude the patient's left eye.

5. Hold the Amsler Grid Chart 30cm from the patient's eye.

6. Make sure the chart is illuminated well and evenly.

7. Instruct the patient to look at the white central fixation point, but at the same time observe the rest of the grid.

8. Ask the patient:

    a. Do you see the white spot in the center? If not, the patient may have a central scotoma. In this case you would go to chart #2 which has diagonal lines passing through the central fixation point to help the patient fixate.

    b. Can you see the four corners and four sides of the square while you are looking at the center dot? If a section is gone, this could be the edge of a scotoma outside of the macular area.

    c. Do you see the entire grid or are some of the lines missing or blurry? If there is a blurred or missing area, have the patient try to trace the area on a recording chart (Figure 2-12).

    d. Are the horizontal and vertical lines straight and parallel? With this question you are exploring the possibility of distortion of vision (metamorphopsia). (Figure 2-13). Again if there is a questionable area, have the patient try to outline it on the recording chart. Using chart #5 or #6 (which are horizontal lines) held in either the horizontal or vertical position may help.

9. Switch the occluder to the patient's right eye.

10. Repeat steps 5 through 8.

11. Attach the recording sheets to a form in the patient's medical records.

12. Notify the doctor of any abnormal results.

AMSLER RECORDING CHART

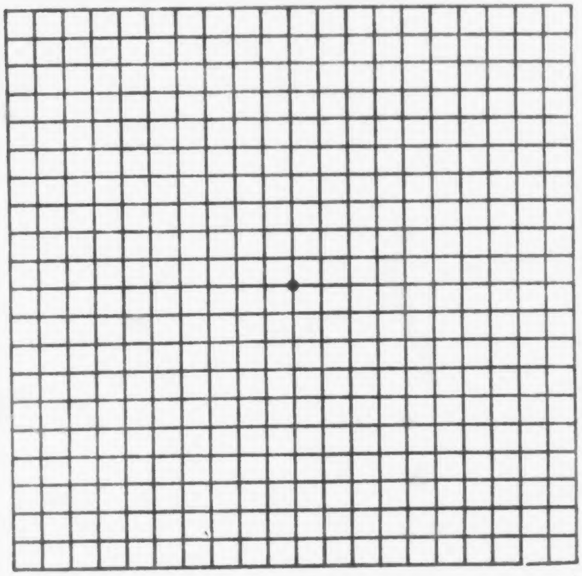


Figure 2-12

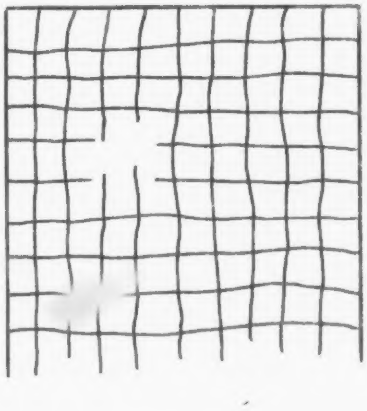


Figure 2-13

As you can see the Amsler Grid Test is a very simple test to perform but extremely important results may be obtained. You will be performing this test on fellow students in class and since abnormal results will only be found in abnormal eyes, you probably will not see any abnormal test results. Of course, the test is usually not performed on the routine patient, but is indicated only when there are complaints about problems with central vision.

You will also notice that there is an Amsler Grid Chart as the last test card of the Harrington-Flocks test.

The Dicon Autoperimeter 2000

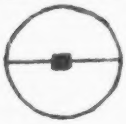
The newest instrument available for performing perimetry combines the proven technology of the past with the wizardry of the future. The Dicon Autoperimeter 2000 is a fully automated programmable visual field tester. It has the capability to perform many specific visual field exams, such as the glaucoma field, the macula study, and the neurological exam. It also has a very excellent screening program, but by no means will we consider the Dicon as a screening tool only. The Dicon is a versitile diagnostic field testing instrument.

Only 3 switches are used to operate the Dicon 2000; the instrument height switch, chin height switch, and the on/off switch. All other operations are controlled by the light pen and the CRT screen. We will work primarily with the standard 72 point screening program.

In the directions for operation below, the box (☐) indicates the appropriate selection to make with the light pen. Simply place the tip of the light pen on the box indicated and press gently. The light pen must be held perpendicular to the CRT screen to operate successfully.

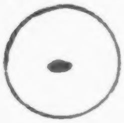
PROCEDURE	EXPLANATION
TURN ON THE PERIMETER	The perimeter may be left on all day. Turn off and cover at night.
INSTRUCT PATIENT	We are going to test your peripheral vision with this computerized instrument. You must look straight ahead at the central green light throughout the test. You will see other lights flash around the outside. Each time you see a light flash, you must quickly press the response button. (AT THIS TIME, HAND THE PATIENT THE RESPONSE BUTTON.) You are not expected to see all the lights; this is normal. Remember, look straight ahead at the green light throughout the test.
DIM OR TURN OFF ROOM LIGHTS	The room must be sufficiently dim so that no shadows are visible in the bowl.
COVER LEFT EYE WITH PATCH	Folding a small tissue behind the patch will insure sanitary conditions as the patch is used on successive patients. Be sure the tissue does not extend beyond the nose and block any peripheral vision.
POSITION PATIENT	Proper positioning of the patient is critical for patient comfort and accurate visual field results. Move the patient and stool close to the instrument so that the patient can sit comfortably with a straight back. If necessary, use the Instrument Height Switch so that the chin rest is about one inch below the patient's chin. Tell the patient to place their chin on the left side of the chin rest (left side when testing the right eye, right side when testing the left eye). While looking through the periscope, adjust the chin rest height to center the patient's eye. The eye is centered when both targets seen through the periscope are positioned directly in the center of the patient's pupil.

NEAR TARGET



Lining up the two targets in the periscope is analogous to lining up the near and far sight on a rifle when aiming. One target is at the far end of the periscope near the center of the bowl. The other target is at the near end of the periscope where the operator looks in. To see this near target, it is necessary to view from 12 to 18 inches away from the perimeter. From this distance, both targets should be clearly visible.

FAR TARGET



The operator should adjust his/her line of sight into the periscope such that the two targets are superimposed. Next move the patient's eye position up or down with the chin rest adjustment switch (on the panel above the screen) until the patient's pupil is positioned directly behind the two superimposed targets.

If necessary, adjust the horizontal position of the eye by asking the patient to move their head slightly to the left or the right until the red light which they see disappears behind the green light.

☐ DEMO TEST

This test presents three stimulus points (randomly located) to the patient and gives the operator a chance to make sure the patient understands the test directions. Before selecting this box, say to the patient: "The test is starting now. Remember, push the button when you see any lights flash."

ONLY IF NECESSARY

☐ CHANGE PARAMETERS
☐ STIMULUS INTENSITY
☐ 500
☐ ENTER
☐ CONTINUE
☐ DEMO TEST

If the patient does not respond and you are sure that the patient understands the directions, increase the stimulus intensity to to 500 ASB. Repeat the demo test at successively higher intensities (160, 500, 1600, 5000, 10000) until the patient responds.

☐ START TEST

☐ (SELECT EYE)

☐ PLOT BLIND SPOT

The test continues automatically from this point to the end of the test.

A small percentage of patients will be "poor fixators"- unable to look straight ahead at the central green light throughout the test. The automatic fixation monitoring system alerts the operator to a "poor fixator" by sounding a buzzer.

ONLY IF NECESSARY

☐ CHANGE PARAMETERS
☐ FIXATION MONITOR
☐ OFF
☐ CONTINUE

Once the patient has lost fixation three times during the test, select Change Parameters and change Fixation Monitor to OFF. It is now advisable that the operator observe the patient's eye through the periscope. Stop the test by depressing the end of the light pen if the patient looks away from the center. Continue the test when the patinet looks center again by releasing the end of the light pen.

The field results are automatically printed at the end of the test and a buzzer sounds three times to alert the operator that the test is completed.

CHANGE PATCH TO
OPPOSITE EYE

☐ START TEST OVER

☐ (SELECT EYE)

☐ PLOT BLIND SPOT Again, the test continues automatically from this point to the end of the test.

AUTOMATIC FIXATION MONITORING SYSTEM

To obtain accurate field results, the patient, must look straight ahead at the central green light throughout the entire test.

Each field test begins by testing the blind spot area. The normal eye will miss a consistent area of 8 to 12 points from a total of 21 points tested. (The area tested covers 8 by 12 degrees of the visual field. The normal blind spot is about 5 by 7 degrees.)

Remember that all blind spots are unique to a particular individual and are dependent on correct patient position as observed through the periscope. Any misalignment will result in displacement of the blind spot.

The computer selects the stimulus closest to the center of the plotted blind spot and presents it to the patient randomly during the test. If the patient responds to a stimulus in his blind spot, the buzzer sounds and the central green light flashes green to red several times to draw the patient's attention back to the center.

All points presented since the last correct fixation check are then randomly retested. This increases the time required to complete the test. Therefore, after three fixation losses, it is advisable to turn off the fixation monitor and observe the patient's eye through the periscope.

The Hemispherical Projection Perimeter (Goldmann)

The state of the art in diagnostic perimetry is without question the hemispherical projection perimeter of which there is many different makers. The model that is most commonly used, and most copied, is the Haag Streit Goldmann Perimeter. The type used in the Optometry Specialist Course is a similar model, manufactured by Marco Instrument Co. (Figure 2-14)

As in all projection perimeters, the test target is a projected light. The difference between the hemispherical type and the arc type (Brombach, Aimark) is the projection surface. The Goldmann type perimeter uses a hemispherical luminescent "bowl" with uniform illumination control. Illumination of the test target and target size is also adjustable. Patient fixation is monitored by the examiner via a telescope-type eyepiece. The test target may be moved into any position throughout the sphere to measure central and peripheral fields of vision, and to plot the normal and abnormal scotomas of each eye. As in all field tests, all isopters are plotted by moving the test target from non-seen areas to seen areas.

Twenty different target intensities may be created by variable filters. Target size is also variable from 1/16mm - 64mm. The size and intensity used depends on the age of the patient, the patient's refractive condition, and the type of test being performed.

Test Procedure - Hemispherical Projection Perimeter

1. Prepare the instrument:

    a. Set target size and illumination (will be determined by your instructor).
    b. Place record chart in holder device.
    c. Place marking device into its proper position.

2. Position the Patient:

a. Explain the test to the patient.
b. Occlude the patient's left eye.
c. Position patient for right eye test so that right eye is lined up with the fixation target, and can be observed through examiner's telescope.

d. Strap patient's head into place firmly, but not too tight as to cause discomfort. Any movement by patinet after initial positioning will necessitate re-positioning.
e. Give patient response button and explain how and when to respond to test target.

3. Begin test:

a. Plot patient's physiological scotoma for the right eye. Auto-marking device is activated by patient's response button.
b. Plot peripheral isopter in at least 8 meridians.
c. Search central areas for abnormal scotomas.
d. Using the examiner's telescope, MONITOR FIXATION CONTINUOUSLY!
e. Use flicker switch if necessary to evaluate the patient's level of cooperation and validity of responses.

4. Record the results:

a. Connect the points of maximum retinal sensitivity to form the isopter. Shade in all blind spot areas.

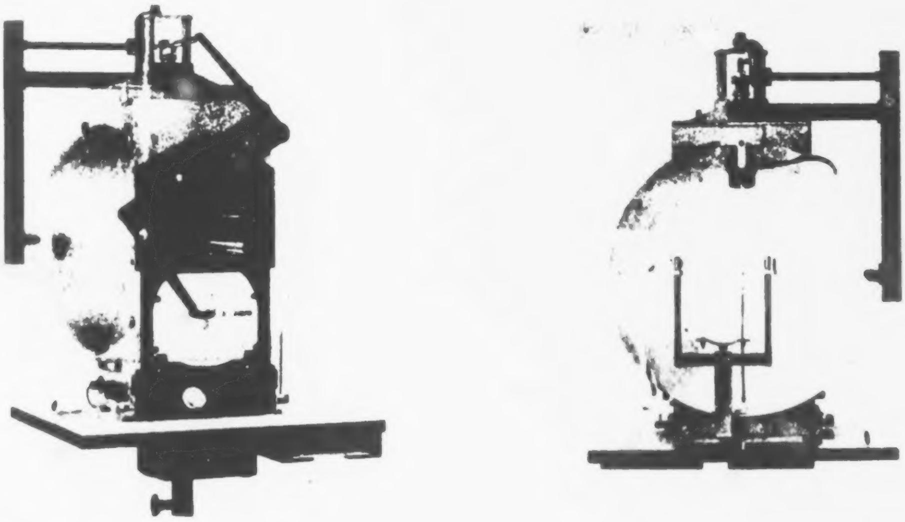
5. Re-position patient for left eye test:

a. Re-position as in 2., occluding the patient's right eye.

6. Test patient's left eye.

7. Record all results.

8. Release the patient.



The Hemispherical Projection Perimeter

Figure 2-14

EXERCISE III-2c

Answer the following questions in the spaces provided.

1. The field of vision for two eyes is called the ________________ field, while the one-eyed field is called the ______________________________ field.

2. Objects within 25°-30° of the point of fixation fall in the ________________________ field, whereas objects outside of this area are in the ____________________ field.

3. The right retina corresponds to the (right)(left) visual field; the inferior retina corresponds to the (superior) (inferior) visual field.

4. Many optic nerve fibers cross over or decussate in the optic chiasm. The right nasal retinal fibers are represented in the ____________________ optic tract.

5. If a lesion severed the right optic tract, which portion of both retinas would be affected? Draw a picture of the resultant binocular visual field.

6. Define "isopter".

7. What is a negative scotoma?

8. What is a positive scotoma?

9. Name the basic instrumentation used in each of the following tests:

   a. Confrontation

   b. Peripheral visual fields only (diagnostic)

   c. Central visual fields only (diagnostic)

   d. Central visual fields only (screening)

   e. Periphera and Central visual fields (computer/diagnostic)

10. At what distances are the following test given? Which test yields the greatest magnification of the scotoma?

a. Confrontation

b. Peripheral visual fields

c. Central visual fields

11. When performing visual field tests, which eye do you usually test first? Which eye is tested first if the patient has amblyopia in one eye?____

12. A visual field defect in the temporal halves of both visual fields would be called a bitemporal ______________________________________.

13. The Amsler Grid is used to detect abnormalities in the central___________degrees of the field of vision.

14. The basic Amsler chart is a grid consisting of___________________lines on a _________________ background.

15. The test distance for the Amsler grid test is ______________________.

16. The Amsler grid tests for _____________________scotomas and also for_____________________________ which means distortion of vision.

17. Which instrument requires straping the patient in position?_______________________________________.

CORNEAL TOPICAL ANESTHETICS

Ophthalmic topical anesthetics (frequently called corneal anesthetics) are used daily in the eye clinic for removal of superficial foreign bodies, to facilitate examination of an injured eye, for minor surgical procedures and to perform tonometry. In your role as an optometric assistant, you may use corneal anesthetics to perform Schiotz Tonometry.

The cornea, probably the most sensitive part of the body, gets its' nerve supply from the ophthalmic branch of the Trigeminal (5th cranial) nerve. This nerve also supplies sensory fibers to the eyelids, conjunctiva, ciliary body, and iris. A drop or two of topical anesthetic quickly deadens the nerve endings in the cornea and conjunctiva. Once analgesia occurs, an eye can be treated with no discomfort to the patient.

SELECTION OF CORNEAL ANESTHETICS

Before instillation of any drug in the eye, be sure the label says "Ophthalmic". There are many anesthetics similar to those used in the eye that are too strong. So be sure that the ones you use are suitable for ophthalmic use. If they aren't, don't use them. The corneal anesthetics that you use end in "aine" or "caine". As with any drugs you administer, coordinate the selection and use of anesthetics with the professional personnel in your clinic.

In order of preference, Proparacaine HCL, Benoxinate HCL, and Tetracaine HCL are three of the most commonly used anesthetics. Although you should coordinate the use of any anesthetic with the professional personnel in your eye clinic, at the same time you should be aware that Tetracaine is not the anesthetic of choice for tonometry. You will be using one of the corneal anesthetics during this course, so be sure to study this section closely.

PROPARACAINE (Ophthaine or Ophthetic) 0.5% solution.

1. Actions: A useful short-term local anesthetic which is approximately equal to Tetracaine in potency. Onset of analgesia is rapid. Duration of action is about 20 minutes.

2. Side reactions and contraindications: Local instillation in the eye produces no serious side effects. Transient corneal edema may occur, but this is unusual. Sensitivity to this drug is extremely rare. This is the drug of choice for tonometry.

3. Dosage: One or two drops of 0.5% solution each eye before tonometry is performed.

BENOXINATE(Dorsacaine) 0.4% solution.

1. Actions: An effective local anesthetic. Onset of analgesia is rapid. Duration of action is approximately 20 minutes.

2. Side reactions and contraindications: The incidence of side effects is low but there may be slight irritation following topical instillation. Mild superficial corneal edema may occur, but rarely. In patients with cardiac disease, thyroid disease, or allergies, this drug should be used with caution.

3. Dosage: One drop each eye before tonometry is performed. For Schiotz tonometry use 0.4% solution. (For applanation tonometry, 0.4% solution combined with 0.25% of sodium fluorescein dye is frequently used.)

TETRACAINE (Pontocaine), 0.5% solution.

1. Actions: A long-acting and surface-active local anesthetic.

2. Side reactions and contraindications: Tetracaine causes more allergic reactions than Proparacaine or Benoxinate. Topical use produces mild irritation. Transient corneal edema may also occur. The drug is quite toxic and not the drug of choice for tonometry.

3. Dosage: For tonometry, use one drop 0.5% solution each eye.

CAUTIONS

Remember that anesthetics are toxic. If they are absored systemically from topical application there is marked stimulation of the central nervous system which could be serious to the well-being of the patient. Caution the patient to NOT rub his eyes for at least an hour after the use of Benoxinate or Proparacaine. Remember that his cornea will be insensitive to pain and he could injure his eye while it is insensitive. Keep the patient under observation for 30 minutes and, if tonometry was performed, examine his cornea before dismissing him.

The use of a corneal anesthetic lowers the ability of the cornea to heal itself, so corneal anesthetics are not recommended to alleviate pain due to injury of the eye. A minor injury could become a dangerous ulcer.

The next section of this SW will provide you with additional information applicable to the use of corneal anesthetics or any other ophthalmic drug preparation. It will cover prevention, recognition, and disposition of drug reactions. Combine your knowledge of this section with the following section so you will have a grasp of the "DOs" and "DON'Ts."

OPHTHALMODIAGNOSTIC MEDICATIONS

Because ophthalmodiagnostic drugs frequently affect pupil size you should familiarize yourself with two terms relating to pupil size, i.e., "mydriasis" and "miosis." Mydriasis is the condition where the pupil is enlarged, and miosis is a constricted pupil. Some drugs are called "mydriatics," or "miotics," with respect to their action on the pupil. Some drugs produce both mydriasis and cycloplegia; these drugs are called cycloplegics. Cycloplegia is the state of the eye where the ciliary muscle of the eye is paralyzed and the eye is unable to accommodate (focus). It is possible to have mydriasis without cyclopegia (depending on the drug used), but you cannot produce cycloplegia without mydriasis. You should remember that a cycloplegic is never used when all that is desired is mydriasis of the eye.

PHENYLEPHRINE HCl (Neosynephrine), 2.5% - 10%

Actions and Uses. Mydriasis without cycloplegia. Effect lasts 2-3 hours. Also produces vasoconstriction. Phenylephrine is the drug of choice in the mydriatic group.

HYDROXYAMPHETAMINE HBr (Paredrine), 2.5% - 10%

Actions and Uses. Mydriasis with little, if any cycloplegia. Also acts as a vasoconstrictor. Pupillary dilation lasts 1-2 hours.

Both Phenylephrine and Hydroxyamphetamine are mydriatics. They are frequently used when the doctor wishes to perform an examination of the eye through an enlarged pupil.

The other group of drugs which produce pupillary dilation, but which also produce paralysis to the ciliary muscle, will be listed next. These are the cycloplegics. They are not used unless cycloplegia of the eye is desired. They usually have a red bottle cap.

TROPICAMIDE (Mydriacil), 0.5% -1%

Actions and Uses. Produces mydriasis and cycloplegia. Onset of action is rapid (15-30 minutes) and its duration of action is short (30 minutes - 4 hours). May be used when a short-acting cycloplegia is desired for refraction of the eye.

CYCLOPENTOLATE (Cyclogel), 0.5% - 2%

Actions and Uses. Produces mydriasis and cycloplegia. Onset of action is rapid (20-30 minutes) and its duration of action varies (2-24 hours). May be used to do cycloplegic refractions. Cyclogel probably produces more cycloplegic effect than Tropicamide.

HOMATROPINE HBr, 1% - 5%

Actions and Uses. Produces mydriasis and cycloplegia which may last up to 72 hours. Used frequently for cycloplegic refractions of children and for treatment of various ophthalmological conditions of the eye.

ATROPINE, 0.5% - 4% (usual is 1%)

Actions and Uses. Produces mydriasis and paralysis of accommodation which may last 2-3 weeks. Used mostly for refractions in small children where pronounced cycloplegia is desired by the doctor. Atropine is also used for treatment of various other ophthalmological conditions.

The next two drugs are the most commonly used miotics and are used primarily to diagnose abnormal pupils or to treat increased intraocular pressure (glaucoma). They usually have a green bottle cap.

PILOCARPINE HCI, usually 2%

Actions and uses. Produces miosis and stimulates accommodation. Also used to increase the outflow of aqueous, thus lowering the intraocular pressure. Pilocarpine is one of the most frequently used glaucoma medications.

PHYSOSTIGMINE SALICYLATE (Eserine), 0.25% - 0.50%

Actions and uses. Produces miosis and some spasm of accommodation. Also used to increase outflow of aqueous to lower intraocular pressure in glaucoma patients.

There is much more you must learn about ophthalmic drugs, especially about their side reactions and contraindications. You will gradually learn more about them in the performance of your Optometry Clinic duties. In the meantime, you would be wise to remember that the judgements pertaining to drug use should be the sole reponsibility of the professional personnel in your clinic. As you become more knowledgable and competent, certain responsibilities concerning the use of specific drug preparations may be delagated to you.

INSTILLATION OF OPHTHALMIC DRUGS

When it is necessary to administer an ophthalmic drug, there are certain guidelines to follow for the benefit and safety of the patient. If done improperly, these procedures may result with serious consequences for the patient. Having followed proper guidelines does not preclude the possibility of an unexpected drug reaction, therefore, it is necessary to recognize a reaction and to know what to do in the event of an undesirable reaction.

Prevention of Drug Reactions

Probably the best drug prevention technique is to take a good case history. Inquire about any drug sensitivities the patient may have experienced. Also ask the patient if he has glaucoma or any other ocular disease.

Look closely at the drug label. Read, then re-read, the drug label to ensure that it is the proper drug to administer. Then read it a third time before administering the drug.

Check the label date. If the drug has exceeded the date on the label, don't use it--discard it and get a fresh preparation.

Be aware that some drugs come in preparations that are for use on other parts of the body. Therefore, it is important that the word "OPHTHALMIC" appears after the description or name of the drug on the drug label. Only ophthalmic quality drugs should be instilled in the eye.

Be aware of the precautionary information contained with the drug. For example, it is not advisable to use mydriatics and cycloplegics on glaucoma or preglaucoma patients; also, it is generally not a good idea to use topical anesthetics on an inflamed eye. Know the other precautions.

Know what the correct dosage is for the result desired, and then administer only the minimum dosage required.

Immediately after instillation, systemic absorption of a drug is lessened somewhat if light pressure is applied over the lacrimal sac for a few seconds. This prevents drainage of the drug into the stomach by way of the nose and throat.

Finally, be sure that you know and understand your doctor's instructions prior to the administration of the drug preparation.

Instillation of Drops

Most patients who are going to be "dropped" are a little nervous--they may not understand what is going on, and may be a little fearful of the procedure. Therefore, your first step will be to reassure the patient. Explain to him what you are going to do, and that it won't hurt. Washing your hands in front of the patient will do a great deal to put him/her at ease.

Instillation of drops into the patient's eyes is a relatively simple thing to do; however, there are certain procedures to observe. Have the patient lean back in the examining chair, and adjust the headrest so the patient is facing upwards. Instruct the patient to look up. With the thumb of your left hand, pull down the skin of his lower eyelid, resting the thumb on the bony ridge under the eye. Place one drop of the ordered ophthalmic drop into the lower conjunctival sac, being careful not to let the tip of the dropper touch the eye or eyelashes. Instruct the patient to close his eyes gently. Apply light pressure over the lacrimal sac and blot the excess medication from the lids with facial tissue. Repeat for the other eye.

The conjunctival sac will hold only one drop. Thus, when an order for eye drops is written without specifying the number of drops, one drop is enough, unless it was not a "direct hit"; then a second drop would be instilled. Do not exert pressure on the eyeball. Do not allow the tip of the dropper to touch the patient. If the dropper or bottle becomes contaminated, discard it.

Most patients tend to blink and squinch up when the drop strikes the eye. This tends to eliminate the medication from the eye before it has had a chance to do its job. To minimize the blink and possible elimination of the medication, retain control of the lid (or lids) for a couple of seconds after instillation. It is also a good idea to let the drop strike the lower conjunctival sac slightly temporal to the cornea. This can be accomplished more easily by having the patient look to his left when dropping the right eye and to the right when dropping the left eye

Recognition of Drug Reaction

Allergic hypersensitivity is the most frequent cause of drug reactions. A reaction to a drug dose which normally would be harmless is called a hypersensitivity reaction. These reactions may vary from moderate swelling and redness to convulsions and death. Because of the wide range of clinical pictures possible, recognition of a drug reaction whould be based on the degree and type of change the patient manifests as a result of the administration of a drug.

Allergic hypersensitivity is a physical reaction to the drug. The eyes may burn, get red, swell, etc. The patient may also fall victim to a psychological reaction. this is called neurogenic shock and is the most common reaction related to ophthalmic drug instillation. It results from the patients fear and anxiety about having drops put in their eyes. When the patient becomes nervous or scared, vasodilation (dilation of the blood vessels) occurs. This results in a rapid decrease in the blood supply to the brain causing the patient to turn pale and possibly hyperventilate. Beads of perspiration may develop on the face and the patient will most likely faint.

Disposition of Drug Reactions

In this case of a reaction, stop instilling the drug, recline the patient, and call a physician immediately. If a physician is not immediately available, obtain the assistance of a nurse or physician assistant until the physician arrives.

EXERCISE III-2d

Answer the following questions in the spaces provided.

1. Corneal anesthetics act on the ophthalmic branch of the ____________________ nerve.

2. Name 3 reasons for using corneal anesthetics

____

____

____

3. The corneal anesthetic of choice for tonometry is __________________ in ____________________% solution.

4. All anesthetics are _______________, therefore, only the minimum amount required to produce the effect desire is used.

5. Systemic absorption of an excessive amount of a topical anesthetic could seriously stimulate the ____________________ ____________________.

6. After the use of a corneal anesthetic, the patient should be cautioned to not __________________ ________________________________.

7. Miosis is the condition where pupil size is ____________________ and mydriasis is where pupil size is ______________________________.

8. The ciliary body is paralyzed by drugs which produce ____.

9. List two mydriatics. __________________________

____

10. List the two shortest acting cycloplegics. ______________________________ ____________________

11. Intraocular pressure is sometimes reduced by drugs which ______________________ the pupil. By deduction, drugs which ________________________________ the pupil sometimes increase the intraocular pressure.

12. If a patient indicated to you that he has glaucoma, you would not use a drug that ____________________ the pupil.

13. Drops which dilate the pupil and cause cycloplegia usually have a ______________ bottle cap whereas drops which constrict the pupil usually have a __________________ bottle cap.

14. Probably the best prevention of a drug reaction is a good ____________________________.

15. List three things on the drug label you would look for before administering eye drops:

16. After instillation of eye drops, light pressure applied to the __________________ for a few seconds helps to lessen the systemic absorption of the medication.

17. ______________________________ is the most frequent cause of physical drug reaction.

18. You should not use ophthalmic preparations in the ___________ or ________________ group on patients who have an elevated intraocular pressure.

19. Before instilling drops, you should first __________________ the patient.

20. The tip of the dropper should not be permitted to touch the ________________________________.

21. When a drop strikes a patients eye, you normally would expect him/her to ____________________. Retrain control of the ______________ for a few seconds to minimize this.

22. It is often a good idea to have the patient look to his/her ______________________ when dropping the right eye and to his/her ____________________________ when dropping the left eye.

INTRAOCULAR PRESSURE MEASUREMENT

You learned previously that there are two fluids within the eye, aqueous and vitreous humor. The aqueous is constantly produced by the cilliary body and it is drained out of the eye through the canal of Schlemm. This relationship between the production and outflow of aqueous is what determines the intraocular pressure (IOP). When the IOP becomes elevated enough to cause tissue damage this is called glaucoma. For our purpose we will define glaucoma as an eye disease characterized by an increase in intraocular pressure that causes pathological changes in the optic disc and changes in the visual fields.

Keeping the IOP within certain limits can be critical to vision, so we need to know how to measure it. The instrument used to measure IOP is called a tonometer. It measures IOP in millimeters of mercury (mm. Hg.)

The two types of glaucoma you might encounter are acute (closed angle) glaucoma and chronic (open angle) glaucoma.

Acute glaucoma is caused by a sudden increase in IOP related to a sudden decrease of aqueous outflow. The cause of the decrease of aqueous outflow is not really known. Acute glaucoma will present itself with an acute onset of redness, pain, nausea, and vomiting. The patient may also see halos around lights and have decreased visual acuity. Examination will show a marked rise in IOP, dilated pupil, steamy cornea and a shallow anterior chamber. Treatment is either medical and/or surgical.

Chronic glaucoma occurs usually without patient symptoms. It is caused by a gradual sustained rise of intraocular pressure. It is characterized by changes in the optic disc and visual field changes (blind spot enlargement and peripheral field loss). Chronic glaucoma also tends to run in families. The incidence of glaucoma increases with age. Persons over age 39 are more likely to develop glaucoma. Treatment is usually medical but is sometimes surgical.

Approximately two or three percent of the population over the age of 40 have glaucoma. Since glaucoma is at the present time the leading cause of blindness in the United States, it is important that you be able to perform one of the tests used to detect glaucoma.

Tonometry is one of the tests you will be doing in the clinic to aid your doctor in detecting glaucoma in a patient. An instrument used in a few clinics is the Schiotz Tonometer (Stock number 6515-00-382-6100) (Figure 2-15)

This instrument measures the depth of indentation of the cornea of the eye produced by a given force acting over a constant area. The identability of the eye is determined in part by its internal pressure, but is not identical with this pressure, nor does it vary absolutely with it. It offers, however, a very satisfactory way of judging the approximate intraocular pressure. The scale reading of the tonometer, while it rests on the eye of the examinee, is translated to calculated intraocular pressure by the use of a calibration table, and the pressure will be entered in item 69, SF 88, or on any military approved eye exam form.

Intraocular Tension will be determined on all examinees who are 39 years of age or older, and in all others when a case history is suggestive of abnormal pressure. When there is a family history of glaucoma, no matter what the age of the patient, a tonometry will be done. Some doctors like to measure the intraocular pressure on all patients.

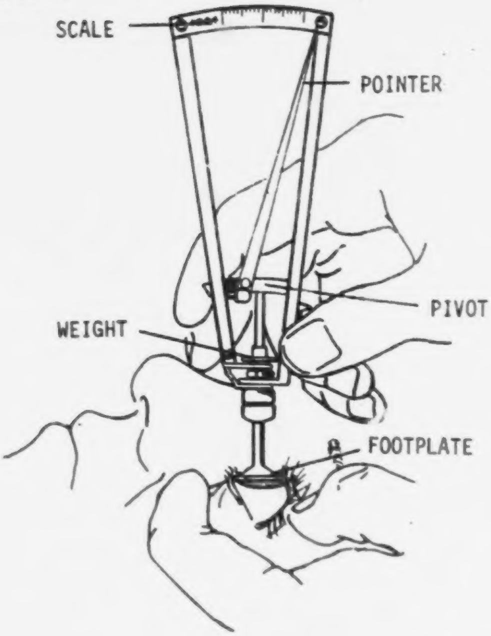

SCALE
POINTER
PIVOT
WEIGHT
FOOTPLATE

Figure 2-15

Tonometry should be as simple and brief as possible. A long buildup to the patient may excite him and affect the readings, as may abruptly confronting him with an instrument poised just above the eye. Lay the examinee back comfortably in such a manner that the plane of the face is parallel to the floor. Take care that the neck is not hyperextended and that there is nothing constricting the neck which would increase jugular pressure. A short-acting topical anesthetic will be used and the examinee will remain under observation for 30 minutes to ensure the absence of adverse reactions as well as foreign bodies impacted during examination.

1. Do not use tonometer on examinees suspected of having conjunctivitis.

2. Be sure that the tonometer zeroes properly on the test block which is provided with each instrument. At the same time make certain that the plunger and the needle move with perfect freedom.

3. Do not use toxic solution for disinfection. Alcohol sponges are usually used. The instrument should be allowed to dry completely if alcohol is used.

4. Use the basic 5.5 Gm weight for the screening examination. If the scale deflection is less than four units, use a 7.5 Gm weight or more as needed to bring the deflection to 4 or greater on the scale.

5. Perform the examination promptly after instillation of the topical anesthetic.

6. Your fingers should be on the bony orbital rims while holding the eyelids open. This will prevent digital pressure on the eyeball which would result in falsely high pressure readings.

7. Before placing the instrument on the eye to be examined, be sure that the patient is relaxed and that his other eye is open, and has an unobstructed view of an object which will allow constant fixation at the proper angle during the pressure determination.

8. Watch for slight smooth and regular fluctuation of the needle. This indicates that the instrument is correctly placed and is functioning well since this reflects the actual pressure pulsation within the eye.

9. When the pressure obtained is abnormal, record the plunger weight and scale reading in item 73, SF 88, in addition to the pressure reading in item 69. Suspect glaucoma when the examinee has tensions as follows:

   a. Two or more current determinations of 22 mm Hg or higher.

   b. One or more determinations of 25 mm Hg or higher.

   c. A difference of more than 4 mm Hg between right and left eyes.

EXERCISE III-2e

INSTRUCTIONS

Complete the following statements in the space provided.

1. Disinfection of the Schiotz Tonometer is usually accomplished by wiping the plunger, tube, and foot plate with ______________________.

2. When checking Schiotz calibration the scale should read ______________________ when the tonometer is placed on the test block.

3. The patient should be positioned so that the plane of the face is ______________ to the floor.

4. Before administering a Schiotz Tonometer you should instill an ______________________.

5. Begin a Schiotz tonometry with a ________________ gram weight. If the scale reading is less than four units add the __________________ gram weight and re measure.

6. To take a reading the tonometer should be placed vertically on the ______________________.

7. After a Schiotz tonometry instruct patient not to rub eyes for __________________ minutes.

BEST COPY AVAILABLE

NON-CONTACT TONOMETRY

Another widely used tonometer is the American Optical non-contact tonometer (NCT). This instrument measures the IOP by firing a puff of air at the cornea. The amount that the cornea is depressed is obtained through a series of mirrors and a mini computer computes the pressure in mm of Hg and gives a digital readout.

Until only recently tonometry was accomplished on patients only when the patient requested the procedure or the patient had reached the age requiring the procedure by regulation.

During the past several years the malpractice issue has become an important issue in every clinic. To prevent any possible legal action against you, your doctor, or the medical facility to which you are assigned, it would be a good idea to do tonometry on every adult that enters your office for any type of visual examination. Should there be a family history of glaucoma or suspected glaucoma, it is imperative that you accomplish the tonometry on the patient and all adult members of the family. Conduct a tonometry on the children to establish a baseline IOP.

Many Optomertry Clinics in the Air Force now have the American Optical Non-Contact tonometer. The NCT has one very large advantage over the Schiotz tonometer in that no topical anesthetics are used in the patient's eye. If an NCT is available in your clinic there will be no excuse to allow any patient entering your clinic to leave without having tonometry accomplished.

THE AMERICAN OPTICAL NON-CONTACT TONOMETER (Figure 2-16)

1. Prepare equipment:
   a. Obtain American Optical Non-Contact Tonometer (original model or NCT II).
   b. Plug cord into wall outlet.
   c. Turn power on/off switch to ON setting.
   d. Insure that value light is on. (digital numbers should read 00 or a steady 65 on the NCT II)
   e. Allow machine to warm-up for 30 seconds.
   f. Remove protective cap from "puff" outlet.
2. Prepare patient:
   a. Seat patient opposite yourself facing machine.
   b. Turn power on/off switch or push middle button to demonstration setting (circled D).
   c. Brief patient on what is going to happen.
   d. Have patient place index finger ½" from "puff" outlet to allow him to experience what is going to touch his eye.
   e. Depress air release button. (Value light should read 57±1 or on the NCT II 50±1 if the machine is properly calibrated.)
   f. Return the on/off switch to ON setting or release the middle button on the NCT II.
3. Adminster test:
   a. Have patient remove glasses or contact lenses if worn.
   b. Have patient place chin in provided chin rest.
   c. Have patient lean forward and place his forehead against headrests.
   d. Align patient's outer canthus with mark on headrest by use of the chin rest ring.
   e. Have patient close his eyes.

f. Lift safety lock knob and ease instrument forward by using the joy stick until the "puff" outlet is about ½ inch from the closed eyelids.

g. Release the safety lock knob.

h. Have the patient open his eyes.

i. Adjust machine to patient's eye level using elevation control and joy stick. The light should be centered on the patient's pupil.

j. Have patient look directly into light at the red dot in light's center. If patient does not see red dot, turn Rx knob until he does.

k. Look in your eyepiece, patient's eye will appear to you as a white globe with a red dot in the center.

l. Adjustment for eye movement is accomplished by the combined movements of the elevation control and the joy stick.

m. When the red dot is clearly in focus inside small black ring - depress air release button.

n. If the signal level indicator light (red light) goes on, or on the NCT II if the digital numbers do not flash, the reading can be considered valid.

o. Take reading from value light.

p. Take two readings on each eye. If they are similar, record the average.

q. Repeat procedure for other eye.

r. Any difference in readings between the two eyes over 3mm Hg should be repeated.

s. A reading of 99, or any reading that cannot be considered valid might indicate that the "puff" has hit the eyelid. Test is to be repeated for that eye.

t. Record results on pertinent form(s).

Example: NCT OD 19
OS 18

Glaucoma is suspected when the examinee has tensions on the NCT as follows:

1. Two or more current determinations of 22 mm Hg or higher.

2. One or more determinations of 25 mm Hg or higher.

3. A difference of more than 4 mm between right and left eyes.

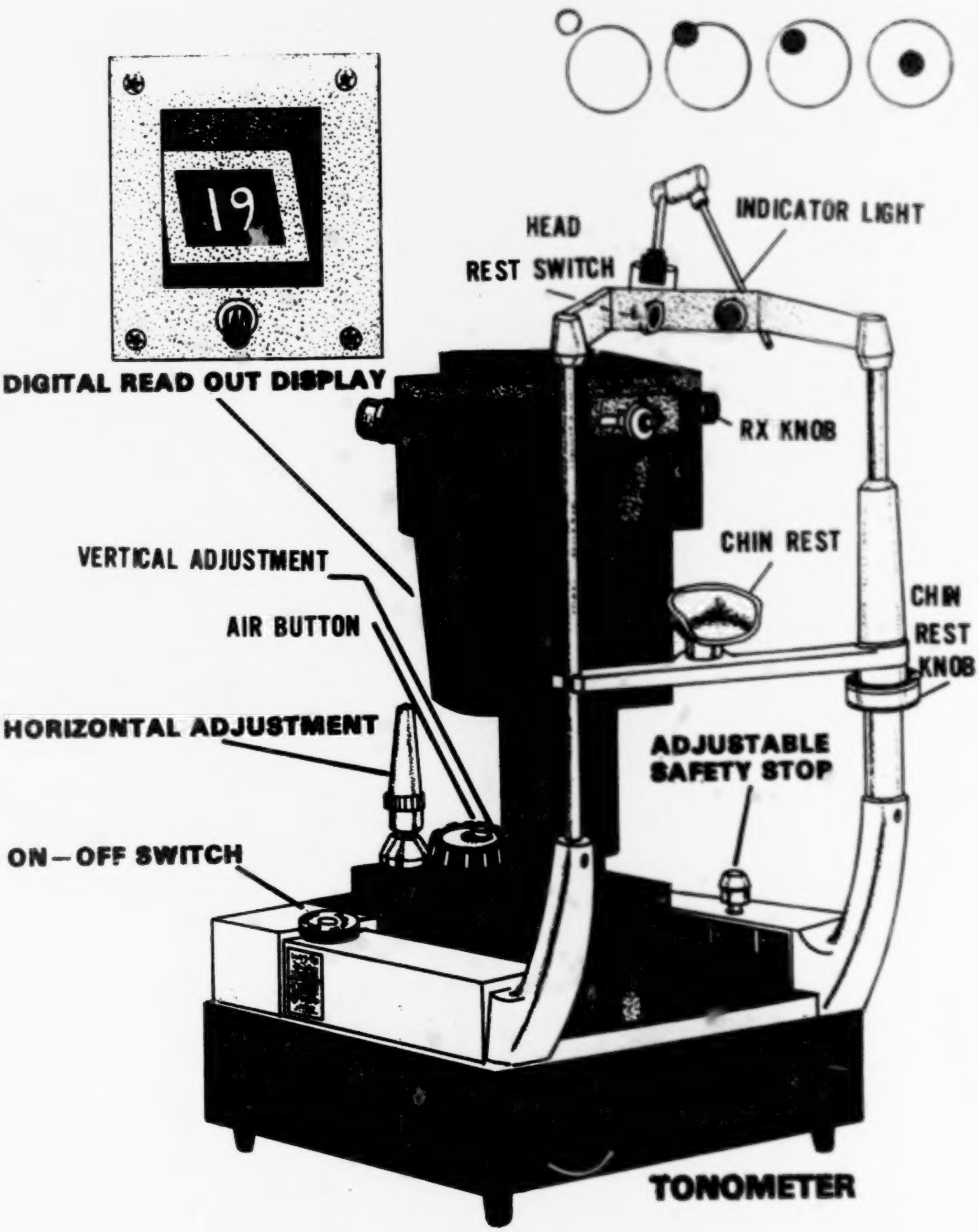

19
HEAD REST SWITCH
INDICATOR LIGHT
DIGITAL READ OUT DISPLAY
RX KNOB
CHIN REST
CHIN REST KNOB
VERTICAL ADJUSTMENT
AIR BUTTON
HORIZONTAL ADJUSTMENT
ADJUSTABLE SAFETY STOP
ON—OFF SWITCH
TONOMETER

Figure 2-16

EXERCISE III-2f

INSTRUCTIONS

Answer the following questions in the space provided.

1. ____________________ Glaucoma is characterized by a sudden increase in IOP, whereas in __________ glacoma there is usually a gradual rise in IOP.

2. List the three intraocular tension measurement combinations which would lead you to suspect glaucoma.

____

____

____

3. When doing an NCT any difference in readings between the two eyes over 3 mm Hg should be ______________________________.

4. A reading of ______________________________ might indicate that the "puff" has hit the eyelid.

BLOOD PRESSURE (BP)

Blood pressure is the force exerted by the blood against the walls of the arteries as it flows through them. Primarily, the volume of blood in the arteries maintains your blood pressure. As long as the amount of blood leaving the arteries is equaled by the amount being pumped by the heart, the blood pressure is stable. Should some of the small elastic vessels relax and accept more blood, or become too rigid and accept less blood, the blood pressure could be drastically altered.

Systolic pressure represents the highest point at which you hear the sound of the heart beat. This occurs when the heart's ventricles contract. Diastolic pressure is the lowest point at which you hear the sound of the heartbeat. This occurs during ventricular rest. (Some people pefer to use the point at which the beat softens, or is muffled as diastolic -- this is not wrong; only more difficult). The average "normal" adult blood pressure is 120/80, but there is a range of normal values depending on individual variations:

Systolic Range: 100-140
Diastolic Range: 60-90

Many factors affect blood pressure in the person who is well. It is normally lower in children, slightly higher for men than women of comparable age, higher in obesity, and higher under emotional distress, excitement or muscular exertion. Disease conditions which affect the circulatory and renal systems may increase the blood pressure; diseases that weaken the heart may lower pressure; pain will elevate pressure; certain drugs may cause an increase or decrease; hemorrhage and shock lower the blood pressure. Terms used to describe blood pressure include hypertension which means elevated BP and hypotension which means lowered BP.

Your responsibilities include accuracy in measuring and recording findings.

EQUIPMENT

Necessary equipment to measure and record blood pressure include a stethoscope (NSN 6515-00-374-3330) and a sphygmomanometer (NSN 6515-00-371-3100) and alcohol sponges. (See figure 2-17 and 2-18)

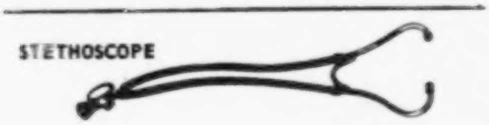


Figure 2-17

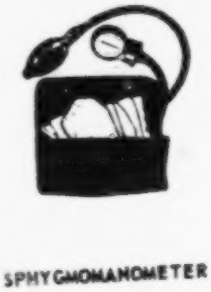


Figure 2-18

PROCEDURE

1. Check equipment for proper function.
2. Clean the earpieces of the stethoscope with alcohol sponges.
3. Explain procedures to patient.
4. Have patient roll up sleeve or remove shirt if too tight.
5. Position patient.
    a. Lying down or sitting.
    b. Place arm in an abducted, slightly flexed position, palm upward.
    c. Support on a firm surface.
    d. Area should be same level as the heart.
    e. Eliminate constriction about the arm and axilla.
6. Apply the cuff.
    a. Cuff should be 1 ½ times as wide as the arm.
    b. Approximately 1 inch above the antecubital space.
    c. Center the inflatable bladder over the brachial artery even and snug.
7. Take the reading.
    a. Close the pressure system by turning the thumb screw clockwise.
    b. Locate the brachial pulse at bend of elbow with your finger.
    c. Place stethoscope disc over the spot where the brachial pulse was felt.

d. While listening with the stethoscope, rapidly pump cuff to approximately 30 mm of pressure above cessation of arterial sound. (Caution: Do not inflate above 160 mm Hg unless you notify an instructor).

e. Observe the sphygmomanometer dial.

f. Deflate cuff at a moderate steady rate. (Not too fast or too slow)

g. Watch the dial and accurately note the first audible sound as the systolic pressure.

h. Note the disappearance of sound as the diastolic pressure.

i. Release all the air in the cuff.

8. Remove equipment and replace patient's shirt.

9. Record BP as a fraction with the systolic as the numerator and the diastolic as the denominator. EXAMPLE: BP 115/80.

10. Clean earpieces, disc and bell of stethoscope with alcohol.

Many beginners have problems in taking BP because the cuff is wrapped too tightly, the stethoscope is pressed too tightly on the brachial artery, the artery is not located, the cuff is deflated too rapidly or slowly, or the specialist cannot believe the sounds that he hears. You need and should seek assistance until you gain proficiency.

EXERCISE III-2g

Fill in the blanks.

1. The average normal range for the blood pressure is ______________________________.

2. The ____________________ pressure is the level of pressure in the arteries when the ventricles of the heart are contracted, whereas the ______________________ pressure is the level of pressure in the arteries when the ventricles of the heart are relaxed.

3. Blood pressure will ______________________ with exertion or emotional stress.

4. When taking blood pressure, the disc of the stethoscope should be over the _________________________.

5. When releasing the air in the blood pressure cuff, the first distinct audible sound is the ______________________ pressure. The __________________ pressure is noted when the sound disappears.

OCULAR SIGNS AND SYMPTOMS

Although the primary mission of the Optometry Clinic involves problems related to the healthy "eye", many patients with ocular pathology (disease) will come to your clinic seeking treatment. The following information is provided to help you recognize some of the more common pathological conditions you may see in your clinic. In most instances, you will need to refer these patients to an Ophthalmologist.

The Red Eye

The "red eye" is probably the most common problem patients have, simply because almost any pathological condition will cause the eye to be red. A red eye can be a sign of conjunctivitis, glaucoma, iritis, keratitis, etc. The trick is to be able to tell one red eye from another. Since conjunctivitis is most common, we will discuss it first.

Conjunctivitis is a term we use to identify inflammation of the conjunctiva and is by far the most common cause of the red eye. Conjunctivitis may be caused by bacterial or viral infections or may be a simple allergic reaction with no known cause. All patients with conjunctivitis should be seen by the ophthalmologist since what may appear to the technician, to be conjunctivitis may be something more serious. Checking the pupil will help you determine whether or not conjunctivitis is present. Usually the pupil is normal in size and in its reation to light with conjunctivitis.

Keratitis, inflammation of the cornea, displays itself as a red eye. The condition can be caused by a foreign body lodged in the cornea or a bacteral or viral infection of the cornea. In either case, refer the patient to the ophthalmologist since keratitis is potentially very serious.

Iritis, inflammation of the iris, is a very serious condition and should be referred immediately. In iritis the conjunctiva is injected around the limbus, the pupil is usually constricted, the eye is painful and the vision may be blurry. The cause of iritis is sometimes not known, but it is known that if treated improperly it can cause blindness.

Glaucoma, as already discussed, is a condition in which the intraocular pressure is elevated to the point of causing retinal tissue damage in the eye. A patient with a sudden or rapid increase in intraocular pressure along with a red eye is symptomatic of acute glaucoma. The patient usually complains of decreased visual acuity and extreme pain in the affected eye. The cornea usually is cloudy, the pupil dilated and the patient will often times report seeing halos around lights. The patient may also be very nauseous and vomiting may occurr which often overshadows the real problem. Acute glaucoma is usually monocular. This is an extremely serious problem which may cause permanent damage to retinal tissue resulting in loss of visual fields if pressure is not reduced quickly. Refer the patient to ophthalmology immediately.

Although you will not diagnose and treat these problems, there are signs that help to differentiate between conjunctivitis and the more serious problems. The three signs that will help you differentiate are pain, pupil size, and visual acuity.

SIGN	CONJUNCTIVITIS	IRITIS	ACUTE GLAUCOMA	KERATITIS
Pain	none usually	mild to severe	severe	severe
Pupil Size	normal	constricted	dilated	constricted
Visual Acuity	good	blurred	blurred	blurred

Always check the visual acuity on a patient with a red eye. This is a must!

Sudden Loss of Vision

A sudden loss of vision is always a serious problem. Refer these patients immediately! There are several conditions that can cause a sudden loss of vision, but there are a few points that will aid in determining the actual cause of the visual loss. The rate at which the vision was lost and how vision disappeared can be important clues to the problem. Some of the more common causes of sudden visual loss are central retinal artery occlusion, central retinal vein occlusion, and retinal detachment.

Central retinal artery occlusion causes a rapid, profound, and painless loss of vision. It is caused by an embolus (blockage) of the central retinal artery (branch of the ophthalmic artery) before it branches to supply the superior and inferior retinas. If the embolus occurs before the branching of the artery, there will be a total loss of vision. If the embolus occurs after the branching of the artery the visual loss may be in the form of a hemianopsia, quadrantanopsia or a small isolated field defect depending on the location of the blockage.

A central retinal vein occlusion is similar to an artery occlusion with a few exceptions. The onset of visual loss is slower in a vein occlusion than in an artery occlusion. The amount of visual field loss depends on the location of the thrombus (clot) and the damage from rupturing of tiny veinules in the retina.

A third cause of sudden visual loss is retinal detachment. This occurs when the retina, for some reason (usually a hole or tear) pulls away from the choroid. Visual loss due to a retinal detachment can be either rapid or slow in onset. Classic symptoms include patients seeing a "veil" coming down over their vision, flashes of light and numerous others (like specks of dust) in their vision. A detachment may affect all or just a portion of the visual field. People with a recent history of eye surgery or trauma are more likely to experience a retinal detachment.

Extreme Photophobia

Extreme photophobia is an abnormal sensitivity to light. Keratitis, corneal abrasions, itritis acuite glaucoma, etc. Some of its causes can be very serious, so you should refer immediately.

EMERGENCY/FIRST AID TREATMENT IN OCULAR TRAUMA

Although the primary mission of the optometry clinic involves problems related to the "healthy" eye, in the absence of an ophthalmology clinic, the optometry clinic becomes the referral point for ocular emergencies. It is important for the optometry technician to acquire a knowledge of proper first aid procedures. Often prompt application of first aid treatment in an ocular emergency may be the means of saving an eye or preserving the vision of the patient. The information provided below is designed to acquaint you with some of the more common ocular emergencies and their proper initial treatment. More definitive treatment is done by the ophthalmology clinic and is not usually the duty of the optometry clinic.

Chemical Trauma

There are many duties in the Air Force which require individuals to work around chemicals which are potentially hazardous to the eye. Chemical burns are exceedingly common from battery acid, cleaning fluids, and lime.

In general, the immediate treatment for most chemical burns is prolonged irrigation with clean water or normal saline. We must stress the importance of the word "immediate" because it is not uncommon for a report to come to the optometry clinic by telephone that a chemical has been splashed into an eye. The optometry technician answering the call must be aware that treatment on the spot is absolutely necessary. The technician should instruct the patient to hold his eye open under a steady stream of water. Use any clean water available, i.e., the patient may have to hold his head under a faucet or even put his face into a bucket of water and blink his eyes rapidly. Sometimes the pain may produce blepharospasm making it very difficult for the patient to hold his eyelids open during the irrigation without finger assistance. In order for irrigation to be effective, the eyelids must be held open.

ACID BURNS. Acid burns have a better prognosis than many other types of chemical burns. Acid burns do not penetrate the eye as do burns from alkali. Acid burns cause almost instantaneous local tissue destruction at the point of contact and do not penetrate the underlying tissue as readily as alkalis.

Immediate treatment consists of immediate irrigation with water or normal saline. The eyelids should be held open. If the patient is in extreme discomfort, a drop of proparacaine can be instilled. Continue irrigation for 20 to 30 minutes. A method to determine if the acid is neutralized is to use pH paper. Touch the end of the pH paper to the fluid in the conjunctival sac; if the paper turns pink, there is some acid remaining in the eye, and irrigation should be continued. If the patient is still showing discomfort, do not repeat the topical anesthetic without authorization since tissue regeneration is slowed by use of topical anesthetics.

After the irrigation has been initiated and the patient somewhat stabilized, the patient should be transported to an ophthalmologist as soon as possible. If eye irrigation can be perfomed in the ambulance, it will be possible to get the patient into the hands of an ophthalmologist that much sooner. Because of the danger of adhesions, it is usually better to delay applying a bandage, until the ophthalmological examination has been completed. At that time an ophthalmic ointment will probably be applied and other appropriate therapy instituted.

ALKALI BURNS. Unlike acid burns, strong alkalis have a tendency to produce a sustained reaction with the ocular tissues. Progressive damage to the eye will continue until the alkali is either removed by irrigation or neutralized.

Immediate treatment is copious irrigation of the eyes with water or normal saline for at least 30 minutes. Once again pH paper can be used to determine the neutrality of the tears in the conjunctival sac. In burns caused by an alkali, the pH must remain normal for at least 7 minutes after irrigation is stopped. If not, irrigation must be resumed. It may be necessary to continue the irrigation for hours. The patient should be placed in the hands of an ophthalmologist as soon as practical, however, irrigation must not be interrupted until there is assurance that the alkali has been compeltely neutralized.

Radiation Trauma

Ocular radiation injuries may be incurred from many sources: furnaces, X-ray equipment, welding equipment, radioactive materials, radar transmitters, and the sun.

ULTRAVIOLET RADIATION. UV radiation may be encountered from the sun or from sun lamps, mercury vapor lamps, electric welders or similar equipment. "Snow blindness" is a term used for ultraviolet radiation damage to the eyes caused by solar UV reflecting from large snow fields. "Welders flash" can be caused from welding without proper eye protection. Usually, UV damage has a latent period of several hours (just like a sunburn), and results in a keratoconjunctivitis (an inflammation of the cornea and conjunctiva). The threshold dose for UV injury to ocular tissues is about twice that of skin (sunburn). Immediate treatment is symptomatic, and usually consists of alleviating the pain with cold compresses. Certain drugs may be used to further alleviate pain and to prevent secondary complications. Most of the radiation burns seen as emergencies are due to ultraviolet.

INFRARED RADIATION. IR radiation may be encountered from furnaces, heat lamps, electric heating coils, etc. Damage to the eye is usually deeper than that seen with UV burns. Although not encountered as an ocular emergency, prolonged exposure to IR radiation may result in cataract. The so-called "glass-blower's cataract" is an occupational hazard of glass workers, for example, occurring several years after chronic exposure to IR radiation. Eclipse burns of the retina may be seen as an emergency caused by gazing at the sun or a solar eclipse. There is a sudden loss of central vision due to the concentration of infrared rays on the macular area of the retina. Permanent blindness of the affected retinal area may result. Prognosis and treatment depends on the extent and severity of the burn. The threshold dose for ocular damage due to IR is below that for skin tissue.

HEAT (FLAME) BURNS. If a person is burned about the face or eyelids from a fire, the eyelids usually close rapidly to protect the eyeballs. An actual burn of the ocular tissue should be treated in the same manner as an acid burn. The eyes may be covered with a sterile moist dressing before transporting the patient for specialized care.

Mechanical Trauma

Mechanical trauma of the eyeball is an all too common event. Snowballs, baseballs, handballs, hockey pucks, etc., are common causes of blunt ocular trauma. Small metallic or carbon particles and glass are common causes of foreign bodies in the eye. However, there is no end to the variations of mechanical trauma which one may encounter.

LACERATION AND CONTUSIONS. Lacerations of the eyelids may appear very serious, but if the eyeball is not involved, there will be no impairment of the patient's vision. However, lacerations of either the cornea or sclera may produce the loss of sight.

When the eyelids are lacerated and the eyeball is not involved, bleeding may be controlled by application of a pressure dressing. However, if the eyeball itself is lacerated, pressure should not be applied to the eye because aqueous and/or vitreous would be displaced and irrepairable damage done to the eye. The patient should be placed on his back immediately. Both eyes can be covered with a loose dressing to minimize movements of the injured eye. The patient should then be gently placed on a litter for transport to surgery.

A common form of corneal abrasion is caused by wearing contact lenses too long. If a patient has worn his contact lenses beyond the normal wearing time, shortly after removing his contact lenses, a severe pain will develop in one or both eyes. The typical clinical picture is pain, lacrimation, and blepharospasm. A drop of topical anesthetic is often necessary to facilitate examination. A fluorescein strip applied to the eye will usually reveal diffuse corneal staining when viewed with the aid of magnification and a black light. A drop of antibiotic should be instilled and a firm patch applied after the patient has been examined by the doctor. Sometimes a drop of 2% homatropine is helpful in relieving the pain of ciliary spasm. The patient should use his ophthalmologist or optometrist for follow-up care, and before he resumes the use of his contact lenses.

Sometimes the eye will receive a blow which does not produce an abrasion but which may produce hemorrhage in the interior of the eye. Bleeding in the anterior chamber (hyphemia) is sometimes evident. A difference in pupil size between the injured and non-injured eye is also often apparent. Although all cases of blunt injury should be referred, immediate treatment consists of making the patient as comfortable as possible after removing any dirt or foreign particles from the lids or eye. If there is considerable swelling of the eyelids, cold compresses should be applied to the affected area. If an eye is extruded after a severe injury, do not attempt to push it back in. Cover the eyes with a moist dressing and move the patient by stretcher for emergency treatment. Blunt injuries are potentially very dangerous due to possible retinal problems, orbital fractures and as stated earlier, internal bleeding.

FOREIGN BODIES (DEEP). Deep foreign bodies or foreign bodies which have penetrated in or around the structure of the eyeball are not always easy to diagnose. It is possible for a tiny particle of metal propelled at high speed to enter the eyeball or orbital structures with only a suspicion of its existence. An X-ray series of the skull is the easiest way to ascertain the presence of these particles.

If a large wound exists and the eye is leaking aqueous, place the patient on his back immediately and apply loose dressings to both eyes. Ready the patient for transport by litter for surgical help. Under no circumstances should you try to remove an imbedded or penetrated foreign body. If a protruding foreign body exists, such as a pencil, a toothpick, a spear of glass, etc., again do not attempt to remove it. Instead place a cone or paper cup over that eye and tape the cup in place with scotch or plastic tape. Apply a loose dressing to the other eye as well before transporting the patient.

FOREIGN BODIES (SUPERFICIAL). The treatment for superficial foreign bodies depends on the type of material present in the eye. A general rule is to irrigate the eye in an attempt to dislodge the particular material. Inert foreign bodies, such as coal, glass, plastic, aluminum and lead frequently require no treatment if they are producing no discomfort. Reactive foreign bodies, even though they are superficial, must be removed. Reactive foreign bodies include iron, steel, copper, wood, and thorns. Removal procedures include irrigation, topical anesthesia, and use of a "Q-tip" or other implement. The cornea should not be stained before the foreign body is removed. If it is concluded that the material is imbedded firmly in the tissue, refer the patient to a doctor who is knowledgeable in the ocular procedures required. An antibiotic and a firm dressing over the injured eye is usually ordered to help healing and to reduce discomfort.

Sometimes superficial foreign bodies lodge on the undersurface of the eyelids. Eversion of the lower lid to examine the conjunctiva is relatively simple. To evert the upper lid, have the patient look down at his feet, grasp the eyelashes with the thumb and finger of one hand and pull the lid gently away from the eyeball. At the same time place an applicator stick horizontally midway across the outer surface of the lid, and pull the lid up and over the applicator. This will expose most of the conjunctival surface of the upper lid. Irrigation or use of a wet cotton-tipped applicator will facilitate removal of any material which may be lightly imbedded in the conjunctiva.

USE OF THE REFERRAL SYSTEM

Not all patients who contact the optometry clinic will need to be seen by the optometrist. Some of them can be handled by the technician, and others will be refered to other hospital services. The following will provide you with some general guidelines for the disposition of your patients, however this may vary from hospital to hospital and doctor to doctor.

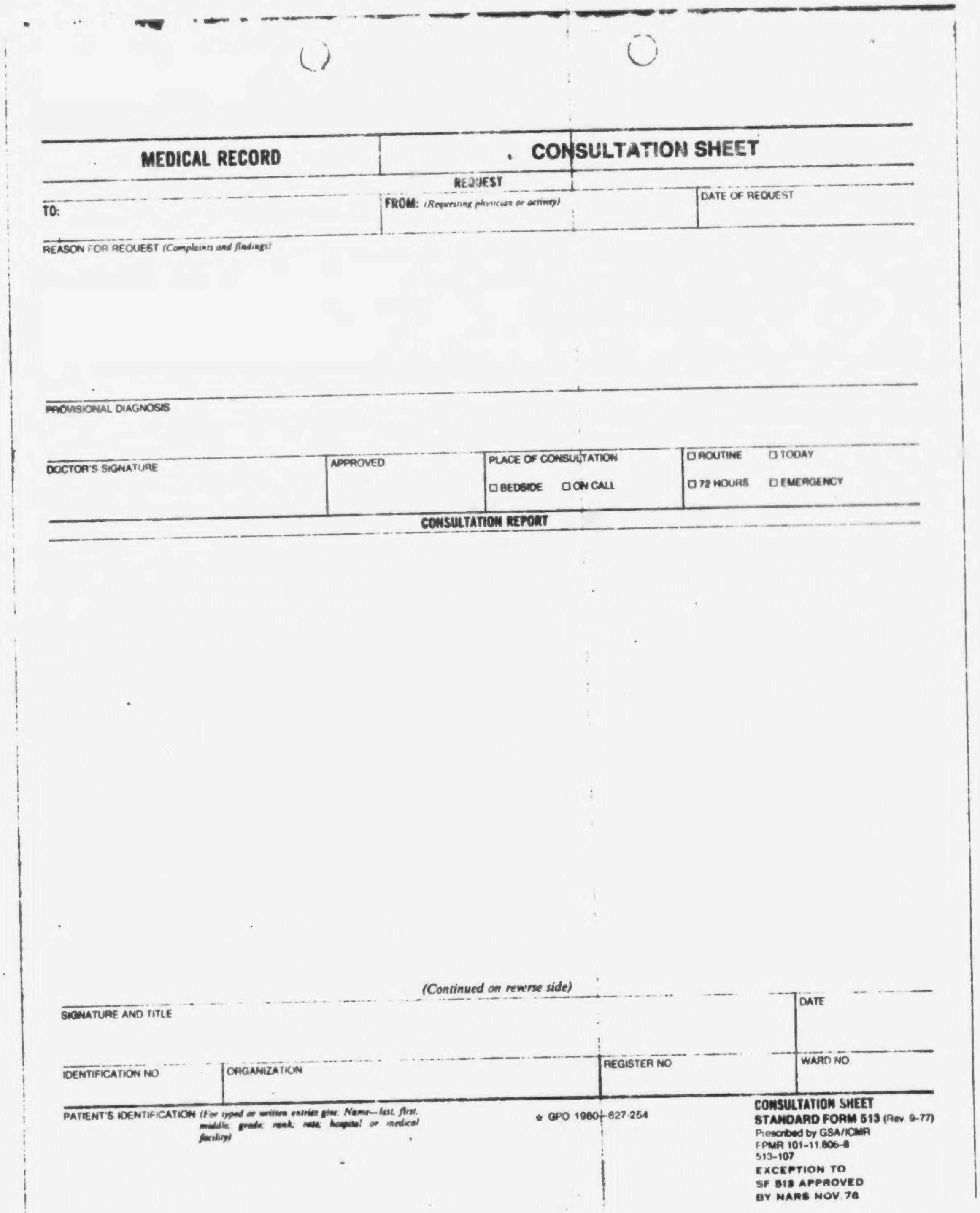
REFERRALS TO OPHTHALMOLOGY. Any patient who has symptoms or shows signs of any external or internal eye diseases or ocular injuries should be refered to the ophthalmologist. If no ophthalmologist is available these patients should see the optometrist.

REFERRALS TO OPTOMETRIST. Those patients who have lost or broken the lenses of their spectacles will need to have a refraction by the optometrist if the spectacles are over one year old or a copy of the prescription is unavailable. If a copy of the prescription can be obtained and they are not over one year old they can simply be duplicated by the technician.

In addition to lost or broken spectacles, patients who have already been seen will probably need to see the optometrist. These may include patients referred from other services or patients who have been screened for visual disturbances either by the optometry technician or other personnel, such as a school nurse (Vision Screening Programs).

REFERRALS TO OTHER SERVICES. During the course of the optometrist's examination it may be determined the patient may have medical problems that will need to be evaluated by a medical doctor. For instance, conditions such as hypertension and diabetes could be indicated by the condition of the ocular blood vessels. These patients should be refered to the appropriate service.

SF 513 - CONSULTATION SHEET. In order to provide as much information as possible to the physician or section you refer your patients to, SF - 513 Consultation sheet should be completed (See figure 2-19). As a minimum this should include the service the patient is refered to, requesting physician or activity, date of request, patient's complaints and any evaluations made by you or your doctor, a provisional diagnosis, signature, place of consultation, and whether the patient whould be seen as an emergency or as a routine visit.



MEDICAL RECORD | **CONSULTATION SHEET**

REQUEST

TO:

FROM: *(Requesting physician or activity)*

DATE OF REQUEST

REASON FOR REQUEST *(Complaints and findings)*

PROVISIONAL DIAGNOSIS

DOCTOR'S SIGNATURE

APPROVED

PLACE OF CONSULTATION

☐ BEDSIDE ☐ ON CALL

☐ ROUTINE ☐ TODAY

☐ 72 HOURS ☐ EMERGENCY

CONSULTATION REPORT

(Continued on reverse side)

SIGNATURE AND TITLE

DATE

IDENTIFICATION NO

ORGANIZATION

REGISTER NO

WARD NO

PATIENT'S IDENTIFICATION *(For typed or written entries give: Name—last, first, middle; grade; rank; rate; hospital or medical facility)*

☆ GPO 1980—627-254

CONSULTATION SHEET
STANDARD FORM 513 (Rev 9-77)
Prescribed by GSA/ICMR
FPMR 101-11.806-8
513-107
EXCEPTION TO
SF 513 APPROVED
BY NARS NOV.76

Figure 2-19

EXERCISE III-2h

PART I - Red Eye

INSTRUCTIONS: Fill in the blanks -

1. ______________________ is the most common cause of red eye.

2. Three signs/symptoms which aid in differentiating red eyes are ______________, ______________, and __________________________.

3. An external cause of red eye where the cornea is inflamed is called____________________.

4. An internal cause of red eye where the pressure in the ye is suddenly elevated is ______________.

PART II - Ocular Trauma

INSTRUCTIONS: Fill in the blanks.

1. The immediate first aid treatment for most chemicals splashed into the eye is ________________.

2. ______________________ chemical burns require longer treatment than do ________________ burns due to their ability to readily penetrate the ocular tissues.

3. The most common type of radiation trauma to the eye is from ___________________ radiation.

4. Looking directly at a solar eclipse will cause a ____________________ radiation burn to the eye.

5. As a general rule the initial attempt to remove a superficial foriegn body from the eye should be by ___________________.

6. To control bleeding of a lacerated eyelid you should _________________________.

PART III - Loss of Vision

INSTRUCTIONS: Fill in the blanks.

1. Three common causes of sudden loss of vision are _____________, _______________ and ______________________.

2. __________________ causes a rapid profound and painless loss of vision, whereas ______________ is characterized by a slower visual loss.

3. Classic symptoms of ____________________ include flashes, bloaters, and seeing a veil over the vision.

PART IV - Extreme Photophobia

INSTRUCTIONS: Fill in the blanks. At least 3 of the 4 answers must be correct.

1. Extreme photophobia is defined as an abnormal sensitivity to ______________.

2. Three common causes of extreme photophobia are _____________, ______________ and ____________________

PART V - Acute Eye Pain

INSTRUCTIONS: Indicate which of the following conditions produce acute eye pain by placing an X by those that do.

_____ 1. Conjunctivitis

_____ 2. Iritis

_____ 3. Keratitis

_____ 4. Acute Glaucoma

PART VI - Referral System

INSTRUCTIONS: Match the signs/symptoms on the left with the appropriate place of refferal on the right.

_____ 1. Patient failed vision screening program.	a. Ophthalmology
_____ 2. Patient states "I owke up this morning and my eyes are all blood shot and itchy".	b. Optometry
_____ 3. Patient's ocular blood vessels show signs of systemic deseases.	c. Medical Doctor
_____ 4. Patient complains of flashes of light and numerous floaters.	

CONTACT LENS CHARACTERISTICS

When we think of contact lenses, most of us think of them as a new innovation, a symbol of the 20th century. Actually, the idea for a contact-type spectacle was pondered as early as 1508 by Leonardo De Vinci, and in 1636 by Descartes in his treatise entitled "Ways of Perfecting Vision." The real history of contacts began in the 19th century simultaneous with the development of spectacles.

With the introduction of anesthesia in 1884, contact lens technology advanced. Now, more accurate moldings of patients' corneas could be performed for fitting of lenses without the earlier discomfort The early lenses were scleral, fitting under the eyelids, mainly because they had to be made of glass, a substance too heavy to allow constant centering needed for today's corneal type lenses. In the 1930's the availability of plastics that were lightweight, transparent, chemically stable, unbreakable, scratch-resistant, and easy to work with changed the course of technology in visual correction.

Although the majority of patients choose contact lenses to enhance their cosmetic appearance., there are several patients that are fitted for "visually essential" type problems for which spectacles are not the best answer. Patients with anisometropia, monocular aphakia, and keratoconus fall into this visually essential category.

Role of the Optometry Specialist.

Because contact lenses are rapidly growing in popularity, you may be called upon to inspect and verify contact lenses to their prescribed specification. The Air Force Optometry Specialist's main job will be to assist the Optometrist in providing advice concerning hygiene, training in insertion and removal techniques, and selection of the proper solutions. The following information is designed to give you an introduction to the basic terms and characteristics of contact lenses.

Types of Contact Lens Materials

Basically there are four types of plastics used to manufacture contact lenses. Many different companies produce many types of lenses from all lens materials, and fitting improvements are made each day.

The original plastic used to fabricate lenses is Polymethylmethacrylate (PMMA). This hard contact lens material was well suited for the majority of contact lens wearers, and still remains a valuable material to enhance the hydrophillic qualities of other lens materials.

In 1964, a Czechoslovakian doctor introduced a soft hydrophillic plastic that had the advantage of comfort and permeability by both water and oxygen. This plastic, Hydroxyethylmethacrylate (HEMA) was first introduced in to the USA by Bausch and Lomb in 1966.

Recent developments include gas permeable substances such as Cellulose Acetate Butyrate (CAB), a plastic commonly used in making screwdriver handles, and silicone, a substance combining the advantages of hard lenses with almost complete oxygen permeability. Now, by combining PMA with silicone, contact lens researchers feel that they have an ideal lens for the majority of refractive problems.

Improvements in the soft lenses or HEMA lenses have been made to increase the water content. Also oxygen permeability, thereby allowing for greater, and even continuous wear. Many new lenses will appear on the horizon in the coming years, as contact lenses become more and more accepted as an alternative method of visual correction.

Characteristics of Contact Lenses

Basically all corneal contact lenses have similar characteristics, many not unlike those of spectacles lenses.

The base curve is the back central curve on the lens. It is specified in mm of radius or as diopters. The base curve of a hard lens is generally gound spherical, but can be made toric for individuals with large amounts of corneal astigmatism. The soft lens has a curve that due to the method of manufacturing is particular in shape, or tends to flatten somewhat from the central area to the peripheral edge. Some contact lens manufacturers call this the Posterior Apical Radius or P. A. R.

The power of a contact lens is determined by the algebriac sum of the front and back curves and the index of refractions (n') of the lens material, pretty much in the same manner as spectacle lens powers are created.

Verification of Contact Lenses

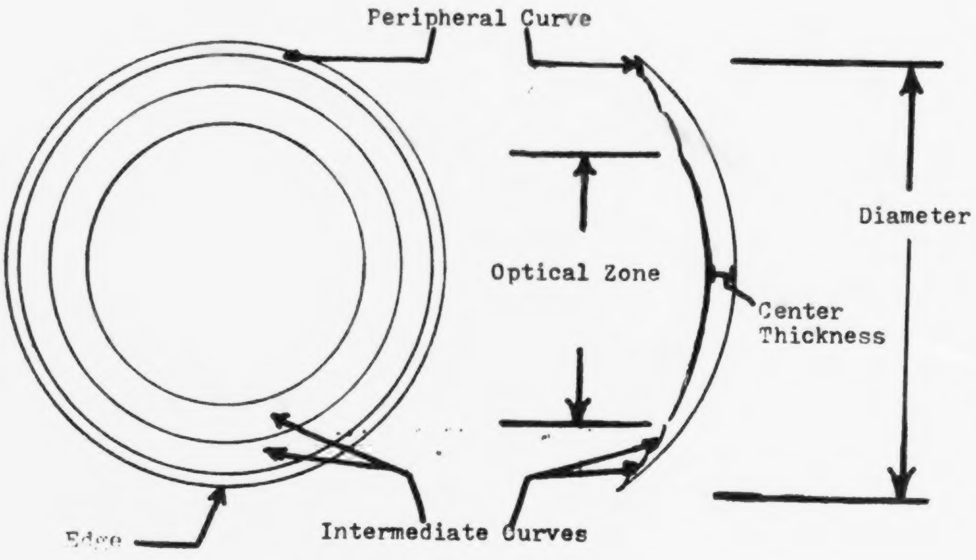
Contact lenses, like spectacles, must be verified before dispensing to insure that they meet the specification requested. In some respects, it may be even more important than the verification of spectacles due to the fact they are in contact with the highly sensitive cornea.

Hard lens verification usually consists of checking these parameters:(2-20)

base curve
power
diameter
OZ
center thickness
edge

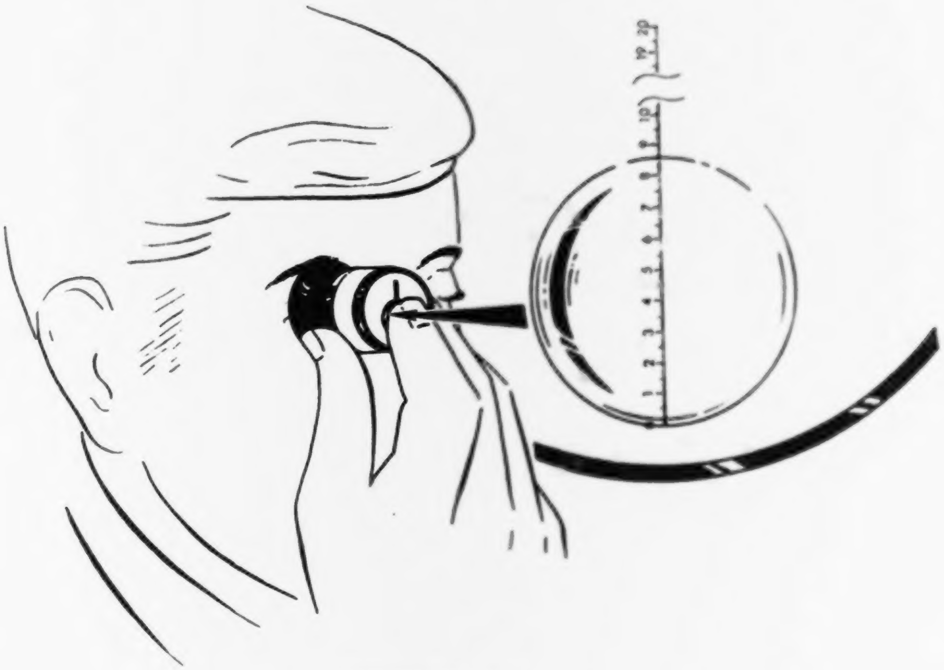
Some of the verification equipment is found in all clinics such as the lensometer used to verify power. Either a radiuscope or an attachment to the keratometer called a con-ta-check is used to verify base curve. The magnifying loupe (figure 2-21 or shadow scope may be used to measure OZ, diameter, and to inspect the lens edge and surface. A thickness gauge or the Geneva lens clock may be used to check center thickness.

Verification of soft lenses consists simply of double checking the parameters listed on the shipping vial with those requested. Because of their elasticity, accurate measurements are difficult with current instrumentation. However, due to the soft lenses susceptibility to contamination and tearing, quality control is strictly enforced, and therefore problems with soft lenses are virtually non-existent.



HARD CONTA

Figure 2-.20


1
2
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10
19
20

MAGNIFYING LOUPE

Figure 2-21

The diameter is the overall width of the lens expressed in mm. The diameter ranges from 7 to 11 mm in hard lenses to 12 to 14 mm in soft lenses.

The optic zone (OZ) of a lens is that portion that carries the correction. The OZ makes up the largest single portion of the lens diameter.

The peripheral curve is the narrow outermost curve of a contact lens. It is normally the flattest curve of the lens, allowing tears to flow under the surface.

Also, additional, or intermediate curves are used between the OZ and the peripheral curve to make the lens more closely approximate the curvature of the cornea. These curves are blended together to make them smoother, and to imporve comfort. The blend is usually specified on a hard lens as light, medium, or heavy.

The center thickness of lenses are expressed in hundreths of a mm. It is usually pre-calculated by the fabricating lab depending on lens power and type.

The edges are one of the more important areas of the lens due to their often being the main factor in patient comfort. Hard lenses are often fabricated with specially "rolled" edges to increase comfort and minimize lid irritation.

Color is a characteristic used in PMMA lenses for easier location of a dropped lens, to decrease light sensitivity, and to enhance a patient's eye color. A specially tinted red contact lens, called an X-Chrom lens is sometimes used for patients who have a red-green color deficiency to enhance their perception of color.

The hard contact lens materials, because of their less pliable properties, require more precise measurements and many times all of the parameters discussed must be specified for the best fit. However, the soft lens, being more flexible and malleable to the corneal surface makes less ordering information necessary. Usually soft lenses require only specification of P.A.R., diameter, and power.

Hard lenses are sometimes modified slightly after their initial fitting to make them fit even better. The only parameter that cannot be modified is the base curve of the hard lens. Soft lenses are simply exchanged for another lens size if fitting problems occur.

Office procedures for modifying hard contact lenses for refinement of fit are usually limited to the following:

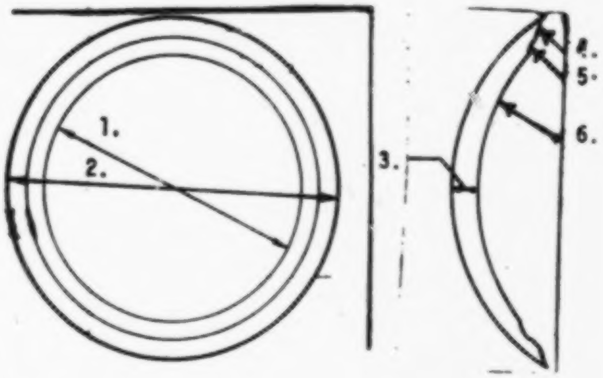
1. Reduce diameter.
2. Enlarge bevel.
3. Change edge configuration.
4. Blend junction of curves.
5. Change power.

EXERCISE III-21

PART I
INSTRUCTIONS

Fill in the blanks with the correct answer. Questions 1 through 6, identify those parameters of a hard contact lens that are shown in the diagrams below.

1. ______________________________
2. ______________________________
3. ______________________________
4. ______________________________
5. ______________________________
6. ______________________________



7. What are the 3 parameters that are usually specified when ordering soft contact lenses?
____________________, ____________________, ____________________.

8. Verification of ____________________ on contact lenses is accomplished with the use of a radioscope.

PART II

INSTRUCTIONS

List 4 common modifications that may be performed on hard contact lenses.

9. ____________________

10. ____________________

11. ____________________

12. ____________________

CONTACT LENS ORIENTATION

Hard Lenses

To preclude the possiblility of infection or disease, certain rules of hygiene must be consistently observed. The hands should be thoroughly washed before handling or inserting contact lenses. A soap should be used which is free of cold cream, deodorant, or medication. Clean the lens with a contact lens solution commercially prepared for that purpose. This is done by placing a drop of the cleaning solution on the concave surface of the lens and then rubbing the solution onto both lens surfaces with thumb and first finger for a few seconds. Rinse the lens with sterile water. Cleaning is necessary to remove any build-up of cosmetics or oily-secretions from the glands of the eyelid. Dirty lenses can produce discomfort and interfere with proper wetting. To wet the lens, use a commercially prepared contact lens wetting agent, place a drop on the lens. The lens is now ready for insertion. After removal, the contact lenses should be stored overnight in an approved soaking solution. Soaking solutions contain antibacterial agents. There are solutions available that are a combination of cleaning, wetting and soaking solutions and can be used for each.

If the technician (or patient) performs the above procedures over a sink, the sink drain should be closed or covered with a towel to prevent loss of the lens if it fell into the sink.

Soft Lenses

Because soft lenses tend to absorb bacteria and other unwanted substances it is imperative that they be cleaned and sterilized daily. Only approved cleaning, soaking and disinfecting solutions should be used on soft lenses. Hard lens solutions should never be used! Daily disinfection may be accomplished by either a heat sterilization method(thermal) or a chemical sterilization method. Once one method is begun, it should not be changed. Whatever disinfection method is used the lenses should first be cleaned. This is done by placing the lens in the palm of the hand, putting a few drops of an approved cleaning solution on the lens and rubbing it with the finger of the other hand. Then it is rinsed with an approved rinsing solution. If a heat disinfection method is used, the lenses are placed in a case in normal saline and the whole case is placed in an aseptor unit. A button is then pushed and after 30-40 minutes the lenses are sterilized and ready for wear. There are presently two types of aseptor units, one which requires distilled water, and a newer type that uses dry heat. If an aseptor unit is not available the lenses may be boiled in water for about 15 minutes. Normal saline should be made fresh daily by dissolving salt tablets in distilled water. Sterile unit doses of saline are also commercially available. If a chemical disinfection method is employed the lenses are placed in a case filled with an approved chemical disinfectant after cleaning, and soaked for a minimum of 4 hours. After rinsing they are ready for wear. It is recommended that weekly cleaning be accomplished using an enzymatic cleaner to remove protein deposits and keep the lenses from yellowing. Though it may be required more often use the enzymatic cleaner as needed.

Because soft contact lenses can absorb substances, some of which are potentially harmful to the eyes or to the lenses themselves, there are certain precautions which are necessary:

1. For storage, use only normal saline solutin or disinfecting solution.

2. Never use fluorescein while the patient is wearing soft lenses or within one hour before lenses are to be inserted.

3. No medicants, opthalmic solutions, or conventional contact lens solutions can be used.

4. Soft contact lenses must be removed before swimming.

5. They must be removed in the presence of noxious and irritating vapors.

6. If there is any possibility that the soft lenses have absorbed a substance that could be harmful to the eye, they should not be worn.

7. Normal saline should be made fresh daily.

8. Use distilled water to make saline, not tap water as it contain impurities.

Insertion and Removal Techniques (Hard Lenses)

Insertion

The patient should start with the right lens and should take special care not to confuse the right and left lenses. The best way to prevent this is to not remove the second lens from the contact lens case until the first lens has already been inserted upon the eye. The contact lens case is clearly marked for right and left lens storage. After the lens has been cleaned and wetted as described, it should be placed on the longest finger of the dominant hand (convex surface on finger). With the other hand, the patient should grasp the upper lid by the margin to prevent blinking. With the third finger of the dominant hand he should hold the lower lid down while advancing the contact lens toward the eye. Using the third finger as a pivot, he can place the lens on the eye. Control of the lids should be maintained for three or four seconds. The last step is to look downward and release the upper lid, then the lower lid.

Centering a Lens

Occasionally, a lens may slide off the cornea onto the sclera or be inadvertently placed onto the sclera during insertion. Remember the lens cannot slip behind the eye. The conjunctiva prevents this. Locate the lens. Then, depending on the location of the lens, slide the lens onto the cornea by gently pushing or nudging the upper or lower lids with the fingers. There is usually enough tearing that the lens can be easily steered onto the cornea in this fashion.

Removal

ONE FINGER METHOD: The lens must be on center before attempting removal. Again start with right eye. Look into a mirror, open eye as wide as possible. (Startled appearance) Place the index finger or second finger at temporal canthus. Pull the canthus back toward the ear, while keeping the eyes wide open. The blink hard and quick. The lens should be ejected by the lid margins. If not, blink again. The other hand may be used to catch the ejected lens.

TWO FINGER METHOD: Some patients are unable to remove the lens with the one finger method. Patients with small fissures or loose lids may do better by using two fingers to remove the lens. Place one finger on the lower lid and pull margin outward. This places the margin tight against the globe at the lower limbus. With one finger of the other hand pull the margin of the upper lid outward to place the margin tight against the globe. Then flip the lens out with a scissors motion of the two fingers.

Insertion and Removal Technique (Soft Lenses)

INSERTION. After the lenses have been cleaned and rinsed as previously mentioned they can be inserted onto the eye as follows:

1. Make sure the lens is not inside out. (Figure 2- 22)
2. Place the moistened lens on the index finger of the dominant hand with the convex side toward the finger.
3. Pull the lower lid down with the middle finger of that hand or the other hand.
4. Look up and keep the eye still.
5. Place the lens on the lower sclera.
6. Remove fingers and look down.
7. The lens should center itself, if not; close the eye and massage to center.

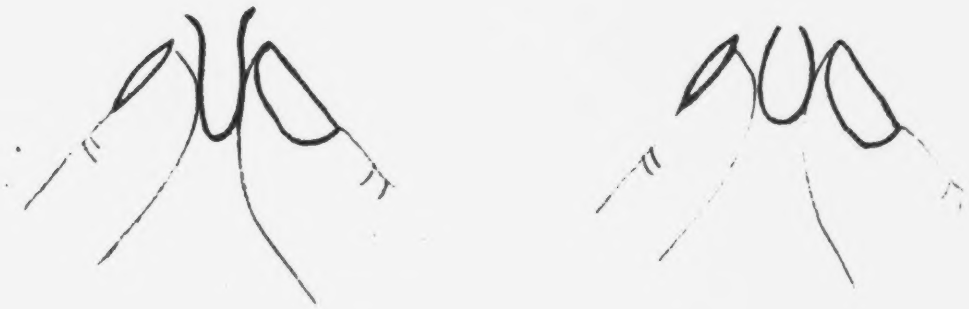

INCORRECT CORRECT

Figure 2-22

REMOVAL.

1. Hold the lower lid down with the middle finger of the non-dominant hand.
2. Make sure the lens is on center.
3. Lightly place the tip of the index finger on the center of the lens surface.
4. Look up and at the same time slide the lens down onto the lower sclera keeping the index finger on the lens.
5. Gently pinch the lens between the thumb and index finger and pull the lens away from the eye.

Contact Lenses in the Military

Military personnel who are not on flying status and who elect to wear contact lenses as a matter of personal preference, must obtain them at their own expense. Military optometrists and ophthalmologists at some of the eye clinics can provide essential professional services in connection with fitting such cases. However, some eye clinics have such a large appointment backlog, little, or no formal contact lens services can be rendered. When your military optometrist can provide the professional services involved in contact lens fittings, the patient can, in some instances, purchase the contact lenses through an arrangement with the Hospital Business Office or through the optical concession at the Base Exchange. However, no money should change hands between the patient and personnel in the eye clinic. This is a violation of the U.S. Code which prohibits collection of professional fees.

Military personnel not on flying status who require contact lenses because they are necessary, i.e., visually essential, can be provided with contact lenses at government expense through local purchase in accordance with AFM 67-1, Volume V, Chapter 16. Personnel in this category should be fitted, if possible, in the nearest available military facility. In some instances a civilian consultant may be used.

Personnel on flying status who require contact lenses for visually essential reasons can only be fitted at the USAF School of Aerospace Medicine (USAFSAM), Brooks AFB, Texas. A formal request to USAFSAM with a full description of medical indications must be submitted for evaluation before TDY to Brooks AFB can be approved. If approval is granted, USAFSAM provides the funds for the contact lenses.

Elective use of contact lenses by personnel on flying status is forbidden by regulation. In addition, individuals scheduled to take a physical examination must not wear contact lenses during any part of the examination. Also, it is essential that such lenses not be worn for three weeks preceding examination for flying classes 1 or 1A.

EXERCISE III-2j

PART I - Advise Patients on Contact Lens Wear

INSTUCTIONS

Identiy appropriate and nonappropriate statements used to advise patients on contact lens care by placing an X by the appropriate statements and a N by the nonappropriate.

_____ 1. Always wash hands before handling the lenses.

_____ 2. In an emergency contact lenses can be safely stored in your mouth.

_____ 3. Soft lenses must be cleaned weekly with an enzymatic cleaner to remove protein deposits.

_____ 4. When disinfecting soft lenses by the chemical method the lenses should be allowed to soak for at least 2 hours.

PART II - Insertion of Contact Lenses

INSTRUCTIONS

Identify appropriate and nonappropriate statements used to advise patients on contact lenses insertion by placing an A by the appropriate statements and a N by the nonappropriate.

_____ 5. In order to keep from confusing the right and left lenses you should not remove the left lens from case until the right has been inserted in eye.

_____ 6. You must make sure that the hard contact lens is placed directly on the sclera so that the lens does not slide behind the eye.

_____ 7. Before inserting soft lenses you should make sure they are not inside out.

PART III - Removal of Contact Lenses

INSTRUCTIONS

Identify appropriate and nonappropriate statements used to advise patients on contact lens removal by placing an A by the appropriate statements and a N by the nonappropriate.

_____ 8. Hard lenses need not be centered before removing.

_____ 9. To remove hard lenses the lid margins must be tightened against the globe by pulling the temporal canthus back.

_____ 10. Soft lenses are removed by pinching the lens with the thumb and index finger.

STUDY GUIDE AND WORKBOOK

J3ABR91235 000-IV

Technical Training

Optometry Specialist

BLOCK IV

VISION CLASSIFICATION

February 1984

SCHOOL OF HEALTH CARE SCIENCES, USAF
Department of Biomedical Sciences
Sheppard Air Force Base, Texas 76311

Designed for ATC Course Use RGL: 10.9

DO NOT USE ON THE JOB

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The Physical Profile---------- 44
Visual Standards---------- 49

This supersedes SW J3ABR91235 000-IV-1, January 1983

Department of Biomedical Sciences
School of Health Care Sciences, USAF
Sheppard Air Force Base, Texas 76311

SWJ3ABR91235 000-IV
February 1984

VISION CLASSIFICATION

This Study Guide and Workbook (SW) is designed to give you information on the use of the VTA-ND (Vision Test Apparatus - Near and Distance)and other tests with special application to complete the SF 88, Report of Medical Examination.

INTRODUCTION

This SW will also give you the necessary information:

Stereopsis Testing

Keystone Telebinocular

The VTA-ND

Amplitude of Accommodation

Near Point of Convergence

Color Vision Testing

The Physical Profile

Visual Standards

OBJECTIVE

Given WS J3ABR91235 000-IV-1a, identify facts about depth perception with 80% accuracy.

CUES OF DEPTH PERCEPTION

In flying, driving, and many other performance functions which rely on visual cues, the ability to perceive depth is of great importance. An individual can determine the relative distance of objects by using at least eight cues directly related to vision. The first of these cues is OVERLAY; if an object overlaps another object, the overlapping object is closer. Another cue is RELATIVE SIZE; objects seen as larger are usually closer. PERSPECTIVE is also an important cue; two-dimensional drawings and photographs give the illusion of depth by proper use of perspective. An object located in the far distance is partially obscured by DISTANCE HAZE, and this may be used as a cue to its relative distance. PARALLAX, the relative change in position of an object with movement of the observer is an important cue.

The amount of Accommodation needed to keep each object clear may also be a cue (the closer the object, the more accommodation exerted). The first of two binocular cues is Convergence. When objects are close, your eyes will converge. The other binocular cue, and perhaps the most important cue to fine depth discrimination at medium to near distances, is STEREOPSIS. Since the eyes are a little ways apart, an object will have an image on a slightly different place on each retina. This retinal displacement is interpreted by the brain as a difference in depth. From this information you could say that a one eyed person could have depth perception but not stereopsis.

All clinical depth perception tests measure stereopsis, and attempt to eliminate the presence of other cues. The Verhoeff Stereopter used an actual difference in depth of test rods to achieve this, while the VTA-ND and Keystone Instruments use special photographs with one portion of the target line displaced laterally to simulate depth. Stereopsis is called a primary cue to depth perception, while the other cues are secondary.

Exercise 4-1a

Answer the following questions in the spaces provided.

1. List eight cues to depth perception.

2. List two binocular cues to depth perception.

3. Can a person with heterotropia have depth perception? Explain.

4. Can a person with heterotropia have stereopsis? Explain.

5. Which cue to depth perception is the primary cue?

6. List four tests which can be used to determine depth perception (stereopsis).

OBJECTIVE

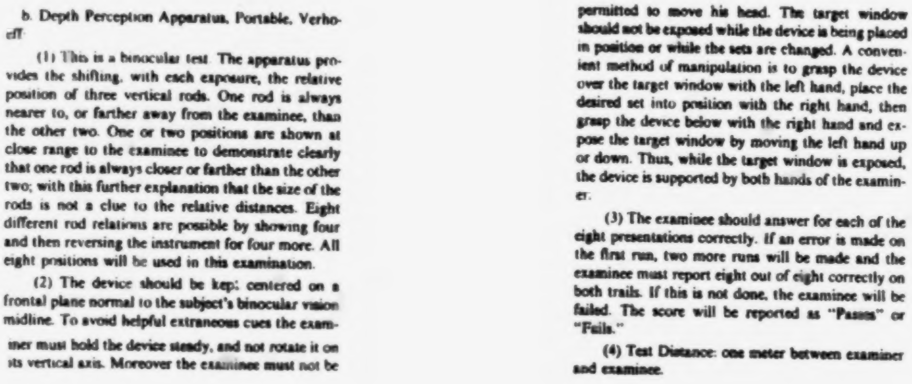
Given the necessary materials and an instructor selected patient, administer stereopsis tests with no more than one instructor assist per test.

STEREOPSIS TESTS

There are several types of "depth perception" testing apparatuses in use in the Air Force. Depth perception testing is required on examination for flying, and many states require testing for driver's license application or renewal. Depth perception testing is also frequently a part of the Optometry Specialist's visual screening exam.

Other than the test performed on the VTA-ND, which will be covered in a future chapter, probably the best recognized test for Air Force physicals is the Depth Perception Apparatus-Verhoeff (DPA-V). This test is mandatory on flying physicals where an examinee has failed the VTA-ND test. Again, this test may be used for other routine exams.

The following information about the DPA-V is extracted from AFM 160-17, 10 July 1972.



b. Depth Perception Apparatus, Portable, Verhoeff

(1) This is a binocular test. The apparatus provides the shifting, with each exposure, the relative position of three vertical rods. One rod is always nearer to, or farther away from the examinee, than the other two. One or two positions are shown at close range to the examinee to demonstrate clearly that one rod is always closer or farther than the other two; with this further explanation that the size of the rods is not a clue to the relative distances. Eight different rod relations are possible by showing four and then reversing the instrument for four more. All eight positions will be used in this examination.

(2) The device should be kept centered on a frontal plane normal to the subject's binocular vision midline. To avoid helpful extraneous cues the examiner must hold the device steady, and not rotate it on its vertical axis. Moreover the examinee must not be permitted to move his head. The target window should not be exposed while the device is being placed in position or while the sets are changed. A convenient method of manipulation is to grasp the device over the target window with the left hand, place the desired set into position with the right hand, then grasp the device below with the right hand and expose the target window by moving the left hand up or down. Thus, while the target window is exposed, the device is supported by both hands of the examiner.

(3) The examinee should answer for each of the eight presentations correctly. If an error is made on the first run, two more runs will be made and the examinee must report eight out of eight correctly on both trails. If this is not done, the examinee will be failed. The score will be reported as "Passes" or "Fails."

(4) Test Distance: one meter between examiner and examinee.

THE STEREOFLY TEST

Although the Keystone and Stereofly test stereopsis, they may not be used to complete information required on an SF 88. Since the Keystone has been discussed,we will discuss the Stereofly test at this time.

The Stereofly test for depth perception will be found in most optometry clinics. We use this test mainly for depth perception testing in children and, when necessary, for adults. The standard Stereofly test set consists of three items: the test booklet, a pair of polarized glasses, and the directions for use.

Testing procedures are rather simple. Seat the patient comfortably. The test booklet should be parallel to the patient's face and 16 inches out. Have the patient wear the polarized glasses. If prescription glasses are worn, the polarized glasses will be placed in front of or behind, whichever is most comfortable, the patient's habitual near Rx. Room lighting should be normal, but do not allow glare from lighting to strike the booklet.

Begin the testing by checking for supression. At the bottom of the right hand page there is a circled "R" and a squared "L" designed for this purpose. If the patient can't see one of these letters,suppression is present and you can stop the test now. If everything is all right have the patient try to grasp the wings on the fly on the same page. When there is depth perception the patient should be pinching about an inch or so in front of the booklet.

If the patient can grasp the fly you should have the patient look at the left hand page. Children should use the animal test and adults should us the rings. Ask an adult which ring appears closer to him. Continue until the patient makes an error. Scoring will be found on the direction card. Score will be in seconds of arc. Ask the child which animal is trying to get out of the cage. PUSH it back in! recorded in seconds of arc as are the rings.

Remember, you can not use the stereofly test for any military physical examination. This test is valuable, however, for drivers license tests and general screening purposes.

Exercise 4-1b

1. What is the correct test distance in conducting the Verhoeff test?

2. If an examinee makes one error in eight Verhoeff presentations, what do you do next?

3. If an examinee gets eight out of eight correct on the Verhoeff test, how is the score reported, i.e., recorded on SF 88?

4. AFR 160-43 states that an examinee must give correct answers through Group D of the VTA-ND depth perception test in order to qualify on Class I, Class Ia, and Class II physicals. If an examinee gets all answers correct through Group D, what should you record on the SF 88?

5. On the VTA-ND test for depth perception, what is the purpose of the arrow?

6. What is the correct test distance for conducting the Stereofly Test?

7. How is the Stereofly test recorded for an adult? For a child?

KEYSTONE TELEBINOCULAR

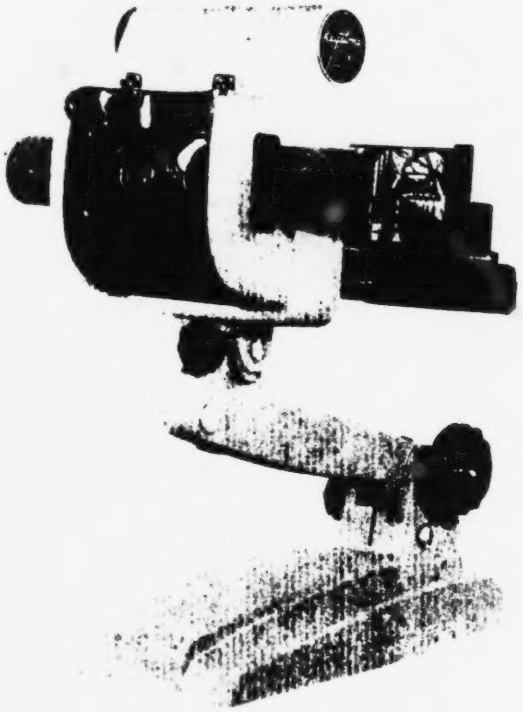
OBJECTIVE

Given the necessary materials, perform keystone visual skills on an instructor selected patient with no more than two instructor assists.

The following information has been extracted from the Keystone Visual Skills Screening Test Instruction Manual, published by Keystone View Company.

This insert will assist you in understanding the procedures for administering visual skills on the Keystone Telebinocular (NSN 651500811657). Some of the tests performed on the Keystone instrument are similar to those described in the AFM 160-17 insert on the VTA-ND. Because of this similarity, we will start this block with the Keystone. You should remember, however, that results from the Keystone can NOT be entered on SF 88, Report of Medical Examination. These tests are recorded on a special form which will be available in class.

The following series of targets are usually given to patients needing a vision screening. Since some of the tests are designed for children, you may order other cards from the company and design your own screening system. Keystone View Co., Division of Mast/Keystone, Davenport, IA.



Keystone Ophthalmic Telebinocular

Figure 1

Procedure for Administering the Tests

The Telebinocular should be adjusted so as to give each eye a full view of its field. Care should be taken that no outside glare interferes with the tests.

It is best to place all stereotargets in the holder. This saves time and permits the control of exposures in the tests where the time element is a condition of the test, as in Tests III and IV.

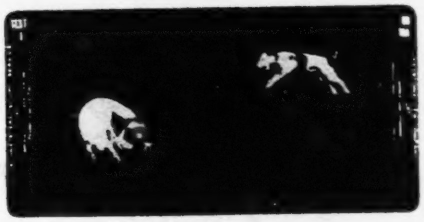
Seat the subject at the instrument and near enough to it so that his back and head are erect, shoulders level but relaxed, and feet flat on the floor or comfortably placed on the rung of the stool or chair.

The instrument is then adjusted to the required height to maintain the desired body posture. Comfortable and correct posture is essential–first, because general body posture is also concerned with seeing; second, because uncomfortable posture will distract the subject's attention from the test. After correct posture has been **attained**, it is to be **maintained** during the entire testing period.

If bifocals are worn, it will be necessary to adjust the instrument and glasses so that the subject's line of vision may pass unobstructed through the bottom of his bifocal segment for the near-point tests, or the amount of the add may be inserted in the lens wells.

Questions	Instructions and Interpretations

TEST I — SIMULTANEOUS PERCEPTION — AT ∞, FAR POINT



DB 10A

"What do you see?"

or

"Do you see dog?" "And a pig?" (Pointing to each.) "Is the dog directly over the pig?"

If a small child seems afraid of the Telebinocular at first, introduce the test by asking, "Do you know about the little pig that went to market?"

The sole purpose of Test I is to determine whether both eyes see [illegible] the same time.

If simultaneous perception is not present, only Tests V and VI can be given.

If the dog and the pig are seen alternately, alternate suppression is indicated.

If only the dog, or the pig, can be seen, except by occluding the dominant eye, gross suspension suppression and/or amblyopia is present.

If the dog, or the pig, cannot be seen when the other eye is occluded, blindness or high amblyopia exists.

Small children may be asked to point to the pig on the **right** side or to the dog on the **left** side, to verify that they are seeing both at the same time.

TEST II — HYPERPHORIA — AT ∞, FAR POINT

DB 8C

"Do you see a yellow line and the red figures?" (Pointing.) "What figure does the yellow line touch?"

The head should be level in the Telebinocular at all times.

If hyperphoria is reported with Rx, repeat test without Rx; the frame may be bent. (This test may well be used when adjusting glasses, especially in the case of strong corrections.)

When the yellow line passes anywhere within the ball and the zero, mark "EXPECTED." When the line passes through the cross, the reading is two diopters of **right** hyperphoria. When the line passes through the star, the reading is three diopters of **left** hyperphoria.

If the yellow line fails to become stabilized and continues to move up and down, mark the limits of the swing. A variable hyperphoria has diagnostic significance.

Answers may be verified by having the patient report when your pointer, held before the **right** eye, touches the yellow line.

The fading of the yellow line at the point where it crosses a red figure has no diagnostic significance. The phenomenon is probably due to retinal rivalry.

TEST III — LATERAL PHORIA — AT ∞, FAR POINT

DB 9

"To what number does the arrow point?"

The patient is to report:

1. To what number the arrow points at the instant the target is exposed by the quick removal of the stereogram in front of it.

2. Whether the arrow remains under the initial number.

3. Whether the arrow moves quickly under some other number and remains there.

4. Whether the arrow swings, pendulum-like, between certain numbers for a time, but eventually becomes stationary.

5. Whether the arrow continues to swing.

If the arrow stands definitely at any point, recording should be made accordingly.

In many cases a response will be delayed by the apparent movement of the arrow. To assist in speeding a response, ask for a number within the range of movement. When this has been obtained, it can be ascertained how far each way the movement continues.

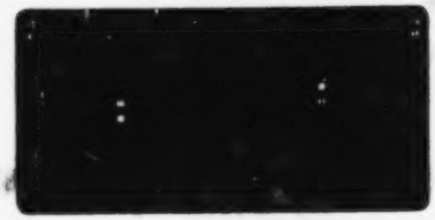
if the movement continues in one direction, recording should not be made until a movement in that direction has stopped. Recording may be made thus: 1——>—1.

Findings falling to the **left** of the "EXPECTED" column indicate exophoria; to the **right**, esophoria.

The posture of the visual axes at the instant of exposure is indicative of their "readiness" to collaborate in the binocular act, and of the speed and efficiency of seeing.

Marked deviations from parallelism or postural instability denote unbalanced accommodative-convergence relationships.

TEST IV — BINOCULAR COORDINATION — AT ∞, FAR POINT



DB 4K

"How many balls do you see?"
or
"Do you see two, three, or four balls?"

1. The target should be exposed **quickly**.

2. The patient should report how many balls are seen **immediately** upon exposure. There may be:

   a. **Three,** remaining three and in **vertical** alignment. Shows that the eyes are postured habitually for single binocular vision, indicating fusion "readiness."

   b. **Three,** remaining three, but in **oblique** alignment. Usually associated with a high phoria. Indicates fusion is maintained with effort.

   c. **Four,** becoming three **instantly.** Has practically the same significance as **a.**

   d. **Four,** becoming three **slowly.**
   Indicates that the eyes are not automatically positioned for fusion, with consequent lowering of performance. Check in Doubtful column.

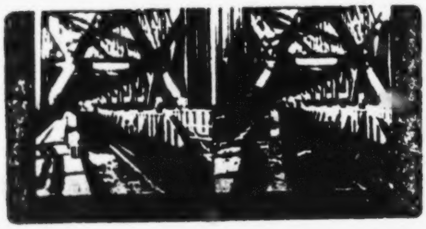
   e. **Four,** remaining four.
   Shows marked interference in accommodative-convergence relationship.

   Look for macular, perimacular, and peripheral cancellation—suppression. See "Supplementary Tests."

   f. **Two** balls.
   Shows gross suppression. Look for amblyopia and squint.

This Test may be considered a recovery at Orthophoria Test. If the Lateral Phoria is not close to Orthophoria, the patient who sees four balls is indicating that positive or negative fusional convergence is weak.

TEST 4½, 5 AND 6. — USABLE VISION, BINOCULAR, RIGHT EYE AND LEFT EYE



DB — 3D Right Eye
DB — 2D Left Eye
DB — 1D Binocular

"You see some signboards. In No. 1 (pointing) you see five white squares. And in one of these squares is a black dot. Is it in the right, left, top, bottom, or center square?"
"Where is it in the other signs?"
(Use pointer.)

It will be noticed that the referential background is identical for both eyes, but that the test target, a black dot, appears only before the eye under test. This arrangement makes it possible to measure the visual response of one eye while binocular vision is maintained, as under normal working conditions. The percentage of vision demonstrated under the conditions of the test will be referred to as "Usable Vision." When usable vision falls materially below 100%, a monocular test of that eye should be made. (A blank card may be held in front of the Telebinocular tube.) Record usable and monocular scores by distinguishing symbols, such as √ for usable and a circle for monocular. (See Cumulative Record Form No. 2.)

Responses should be prompt. If the subject hesitates, indicating an effort to guess, the last previous response should be checked as final.

The elimination of letter targets avoids the factor of recognition of familiar contours, present in the use of the Snellen Chart. The usable vision score cannot be correlated with the findings of the standard Snellen test. While the Snellen type of test measures the maximum of monocular acuity under occlusion, the usable vision test scores the **habitual** performance of each eye under fusion. The usable vision test does not necessarily elicit maximum acuity; rather, the purpose of the test is to determine whether there has been any functional loss of vision. When the response under association is lower than the monocular finding (under occlusion), the impairment may be attributed to central suppression and signifies that a visual problem exists. It is generally accepted that the earliest skills loss occurs in the central field. Here, then, the first sign of interference between patterns is to be looked for. Consequently, Tests V and VI assume major diagnostic significance in the investigation of visual problems.

The findings secured in the usable vision test may properly be subjected to further specific evaluation. Suppose a not uncommon occurrence: a patient, doing a great deal of reading, cannot go beyond No. 6 target, but when the other eye is occluded No. 9 target is readily located. The difference in monocular and binocular performance levels can be accounted for only on the hypothesis that when the demand is for better than 20/60 vision binocularity cannot be maintained in the central field. Since much reading matter requires visual acuity above 20/60, the response signifies inadequate adaptation to the given task. This is to say, the acuity level at which suppression occurs may give information as to the nature and the extent of the existing problem.

The procedure is excellent for demonstrating to the patient the nature of his difficulty. Personal appreciation of his problem is necessary to obtain his full cooperation for whatever correction program is necessary.

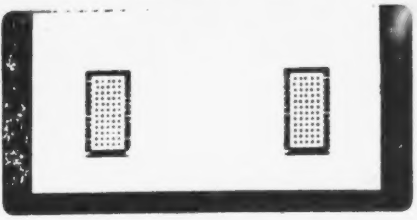
The conventional examination includes no equivalent test for detecting the subtle concessions made to maintain clear, single and efficient vision.

NOTE: Snellen equivalents on Tests V and VI are valid only when **one eye is occluded**:

50%	70%	84%	88%	92%	96%	98%	100%	103%	105%
20/100	20/60	20/40	20/32	20/28	20/25	20/22	20/20	20/17	20/15

DB 2D

TEST VII — STEREOPSIS — AT ∞, FAR POINT



DB 6D

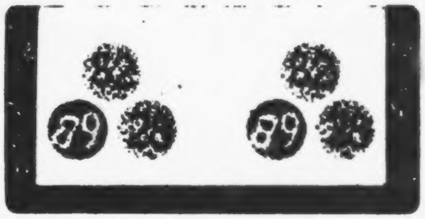
"You see (pointing to each figure in the top line) a star, -- square, -- cross, -- heart and ball. Does one of them seem to be closer to you than the rest?
Which one in the second line?" etc.

When a visual problem arises, binocular foveal fixation is the first skill to be suppressed. (See Test V.) Since refined space judgment is based on binocular foveal fixation stereoscopic awareness also suffers loss at any early date. Deterioration of depth discrimination becomes corroborative evidence of central depression.

DB 6D is a screen-out test. Failure on any part of this test signifies need of corrective attention. When a more critical test is desired, as a criterion for progress examinations or where exact information is needed, use Stereometric Units DC1-23, or DC31-53 or the Keystone Multi-stereo Tests.

Be sure that the patient understands what he is to look for. Instructions should be given slowly and clearly. Sometimes it is necessary to point out the correct character in the top line before he understands what is wanted.

TEST VIII — COLOR-PERCEPTION TEST (FOR SEVERE DEFECTS) — AT ∞, FAR POINT



DB 13A

Read the number (pointing) in the top ball.

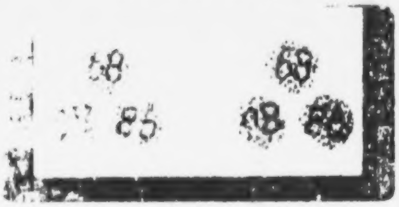
Read the number (pointing) in the lower left ball.

Read the number (pointing) in the lower right ball.

Do not permit the patient to study the target or delay too long.

Score by checking correct readings on the record form. Two balls, both digits, correctly read are passing. Two balls, both digits, incorrectly read indicate failure and red-green color blindness.

COLOR PERCEPTION (FOR MILD DEFECTS) — AT ∞, FAR POINT



DB 14A

Read the number (pointing) in the top ball

Read the number (pointing) in the lower left ball

Read the number (pointing) in the lower right ball

Do not permit the patient to study the target or delay too long.

Score by checking correct readings on the record form. Two balls, both digits, correctly read are passing. Two balls, both digits, incorrectly read indicate failure and mild red-green color blindness.

NEAR-POINT TESTS

It is generally accepted that fatigue is caused by prolonged concentration within a restricted area. The responses evoked in the following near-point tests becomes, therefore, especially informative when the chief use of the eyes is at close range.

TEST X — LATERAL PHORIA — AT 2.50, NEAR POINT

DB 9B

Procedure and interpretation same as for Test III.

Indicates the effect of 2.50 diopters of accommodation on the position of the visual axes.

TEST XI — BINOCULAR COORDINATION — AT 2.50, NEAR POINT

DB 5K

Procedure and interpretation same as for Test IV.

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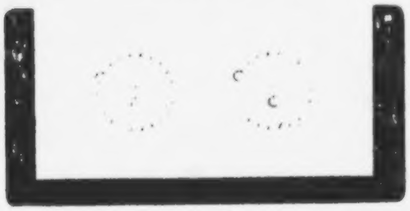
TEST XII — BINOCULAR ACUITY — AT 2.50, NEAR POINT



DB 15

"On these balls (pointing to each in center) you see **lines, dots,** or **gray.** Which of these patterns do you see, starting with No. 1 (pointing)?"

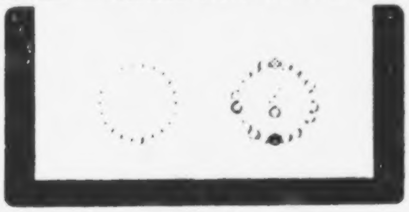
It is well to tell the patient the patterns on balls 1, 2 and 3 in this manner "Ball 1 has black dots; Ball 2 has black dots; Ball 3 has black lines."

The conditions of the test are the same as in Test V, that is to say, the Usable Vision of each eye can be determined while fusion is maintained. The interpretations pertinent to Test V are valid here. The general observations at the head of the Near Point section should be noted, because suppression of central fixation at the working distance may be more directly significant of the existing visual problem.

Do not hurry the subject, but at the same time do not give him too much time for study or allow him to guess. When a ball is miscalled and obviously not seen clearly, or when guessing is obvious, check on the record form at this point.

NOTE: In dealing with children it is well to allow them to proceed beyond the point where they miss one ball. Do not stop the child on his first miscalled ball. If he can go on and give additional correct responses, let him proceed until he makes two mistakes successively. Then say, "Tell me again what you saw on Ball 6 (Miscalled)." Often it will be found that the child simply made a mistake in reporting on the first miscalled ball.

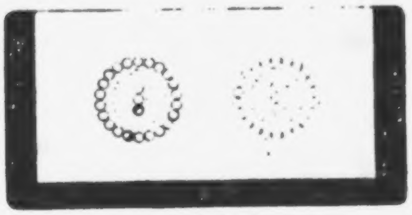
TEST XIII — USABLE VISION, RIGHT EYE — AT 2.50, NEAR POINT



DB 16

Procedure is same as in Test XII.

TEST XIV — USABLE VISION, LEFT EYE — AT 2.50, NEAR POINT



DB 17

Procedure is same as for right eye.

SNELLEN EQUIVALENTS:

NOTE: Snellen equivalents on Tests 12, 13, and 14 are valid only when **one eye is occluded:**

10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
20/200	20/100	20/67	20/50	20/40	20/33	20/28	20/25	20/22	20/20
102%	103%	105%							
20/18	20/17	20/15							

Exercise 4- 1c

1. What is the purpose of the "dog-pig" slide?

2. If the yellow line on test 2 goes through the red square, is the patient left hyper or right hyper?

3. If the arrow on test 3 points to the number 13, is the patient exo or eso?

4. At what equivalent reading distance are the Near Point tests performed?

5. Should you record results from the Keystone on a SF 88? Explain you answer.

THE VTA-ND

OBJECTIVE

Given the necessary materials, perform VTA-ND testing on an instructor selected patient with no more than two instructor assists.

The following information has been extracted from AFM 160-17, Medical Examination Techniques. Further extracts will be found when each topic is presented.

The pass/fail standards for each test will be found later in this SW when AFR 160-43 is presented.

3-4. Vision Test Apparatus, Near and Distant (VTA-ND). The vision testing stereoscope, Stock No. 6515-299-8048, combines the testing of several visual functions. It is the test of choice and, when available, will be used in all examinations.

a. Additional Vision Tests Required for Flying:

(1) Refraction.
(2) Accommodation.
(3) Color vision.
(4) Field of vision.
(5) Red lens test.
(6) Cover test.
(7) Near point of convergence.
(8) Intra-ocular tension.

b. Operational:

(1) One examinee will be tested at a time with one instrument. The examinee observes a series of test slides, some of which test his distance vision, others his near vision. The examiner will ask standard questions while the examinee is observing each slide and will determine his instrument score from the answers to these questions. The visual functions tested are vertical and lateral phoria at distance and near, right and left eye acuity at distance and near, and depth perception at distance.

(2) The instrument may be adjusted for individual differences in eye height by lifting or pressing on the bar handle at the back. (See figure 3-1). The brake lock lever at the right may be tightened to prevent any change in elevation, but normally is tightened just enough to permit change in elevation by slight pressure on the handle. A plastic cover is placed over the instrument when it is not in use.

(3) The distance slides are in the large drum rotated by crank F (for "far") into any of eight positions. The near slides are in the small drum, rotated by crank N (for "near") into any of the five positions. A spring stop holds each drum accurately at any position. At each position a different test slide will be presented. The distance slides are viewed by the examinee at a slightly downward angle, and the near slides at a greater downward angle. Each drum has a light inside, both operated by a single switch on the base of the instrument at the right. A small ruby window in the right side of the instrument shows when the lights are on.

(4) The viewing box is tipped up for the far slides or down for the near slides by means of the loop handle under it. The change can be made from one position to the other without disturbing the head position (except for presbyopes while wearing bifocal spectacles) of the examinee. Inside the viewing box an occluder may be turned to either side to block the view of either eye. It is operated by means of the handle under the box.

(5) In addition to the vision tester itself, the equipment includes one demonstration device, answer key, and a supply of record cards.

(6) The instrument and the auxiliary equipment will be placed on a substantial table 28 inches to 30 inches high with knee room beneath and at least several square feet top-surface area. Chairs should be straight and not inclined backward. The vision tester is connected by means of its electric cord to a 110-120 volt outlet (a. c. or d. c.).

c. Instrument Maintenance. Test slides may be removed for replacement when necessary. Lifting the lid of the instrument gives access to the slides in the far drum. Slides in the near drum are reached by withdrawing the pin stop, which limits the downward movement of the viewing box, and swinging the box to a secondary stop provided for that purpose. Bulbs should be dusted occasionally and should be replaced if they appear blackened. A slight counterclockwise rotation of the external portion of the light sockets releases the entire bulb assembly so that it may be withdrawn from the instrument. If the bulb needs to be replaced, slide the metal cap off the bulb before removing it from the socket. When a new bulb is screwed into the socket, it must be positioned precisely as before. The proper position for the bulb can be ascertained by observing the relationship between the support wire and the slot in the socket assembly in the case of the original bulb. (When the bulb is being inserted in its socket, the socket assembly should be held so that the slot is at 7 o'clock and the bulb placed

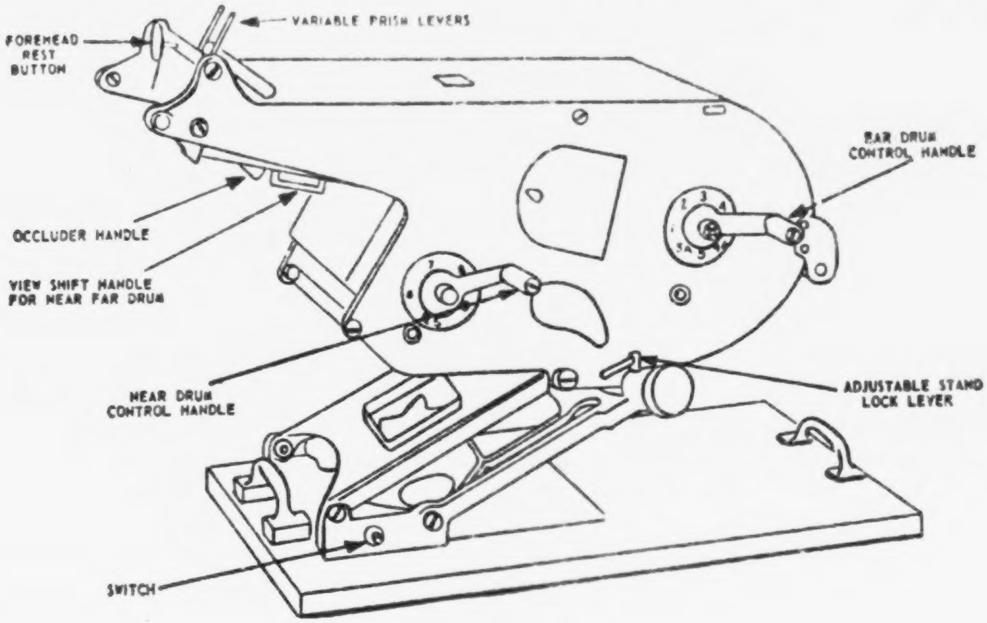


Figure 3-1. Vision Test Apparatus, Near and Distant (VTA - ND).

so that the filament support is located between the 1 and 5 o'clock positions. The metal cap should be placed over the bulb with the bar at approximately 3 o'clock.) Each cap is stamped on the end with the letter N or D. The cap marked N is for the lamp in the near drum and the one marked D is for the distance drum. These caps control the evenness and intensity of illumination and must always be used in their proper place.

d. Adjustment of Instrument. The examinee will sit before the instrument and will bring his chair under the table as far as is comfortable. The chair must be squarely facing the instrument. The examiner will adjust the height of the instrument and the examinee will lean his forehead against the headrest. In the correct position the examinee is looking through the center of the viewing lenses. When the viewing box is lowered to the near slides, he should not have to move his head (except for presbyopes while wearing bifocal spectacles); he still looks through the center of the viewing lenses. The center line of vision for the distance tests is not parallel with the top of the instrument, but at a slight downward angle directly in line with the main hinge of the viewing box and the shaft of the big drum. The examinee's eyes should be centered on this line. For the near tests, the center line of vision is in line with the main hinge on the viewing box and the shaft of the small drum, and the examiner sits on the right side of the instrument facing slightly toward the examinee. The examiner must watch constantly to see that the examinee's forehead is against the headrest, that both of his eyes are kept open without squinting, and that his head is not tilted.

e. Test Sequence:

(1) The tests are given in the order shown on table 3-1.

TABLE 3-1. Test Sequence.

Name of test	Drum	Position No. and slide No.
Far vertical phoria	Far	1.
Far lateral phoria	do	2.
Far acuity	do	3 and 4 or their alternates 3A, 4A.
Depth perception	do	5 or its alternate 5A.
Near vertical phoria	Near	6.
Near lateral phoria	do	7.
Near acuity	do	8 and 9.

(2) Tests 1 to 5 are in the back or "far" drum controlled by crank F.

(3) The near tests are on the front or "near" drum controlled by crank N. These tests will be given with the viewing box in the lower position.

f. Recording of Results. Each examinee will make an instrument score on each test. This score is a simple number or letter that indicates his performance on the machine. This instrument score is not a numerical measure of the visual ability tested. For example, in the vertical phoria test a score of 9 is not superior to a score of 1, and a score of zero does not mean complete absence of the ability tested. The scoring key attachment 3 gives the correct or true score for each instrument score. The "true score" will be entered on SF 88.

g. Test Procedure. If an examinee has correcting glasses, he will first take the entire series of tests without his glasses and then repeat the entire series with his glasses.

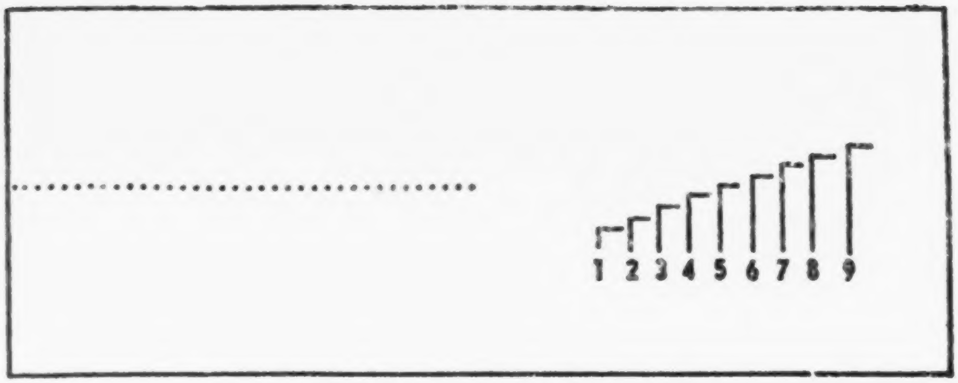
(1) Drum position 1, far vertical phoria (figure 3-2):

(a) The examiner will place the occluder in the midposition so that it does not block either eye and instructs the examinee to put his head against the head rest. He then asks the standard questions: "DO YOU SEE A WHITE DOTTED LINE? DO YOU SEE A ROW OF NUMBERED STAIRSTEPS? WHERE IS THE DOTTED LINE IN RELATION TO THE NUMBERED STEPS?" If the examinee says no to the first or second question, the examiner will put the occluder before the left eye and ask, "DO YOU SEE SOME STAIRSTEPS?" Then with the occluder before the right eye he will ask, "DO YOU SEE A WHITE DOTTED LINE?" With the occluder in the midposition he then asks, "NOW DO YOU SEE BOTH THE DOTTED LINE AND THE STAIRSTEPS?" If the examinee says no to any of these three questions, the test will be discontinued. If he says yes, the standard question will be repeated. The instrument score is the number (1-9) that the examinee answers. If the dotted line is below step 1, the score is zero, if above step 9, the score is 10. If the test is discontinued because of failure to see either the dotted line or the stairsteps, the score is X. Caution: All answers of 1, 2, 8, or 9 will be verified by asking, "THE DOTTED LINE IS AS HIGH AS THE TOP (OR BOTTOM) OR THE STAIRSTEPS?"

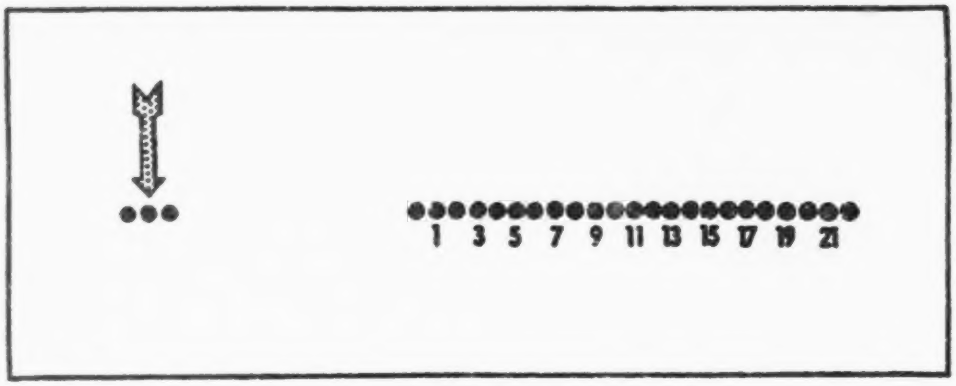
(b) Detection of Malingers. It would be possible for the examinee to feign a normal phoria if he knew that a score of 5, for example, is normal. To avoid this, an auxiliary device is provided by means of which the examiner can lower either the right or the left eye image. This device is known as the variable prism. Its two control handles are shown in figure 3-1. The correct score and the only score recorded is that obtained when both control handles are pushed inward as far as they will go. This is known as the scoring position. Moving the left handle outward from this position moves the left eye image downward and outward. Similarly, moving the right handle outward moves the right eye image downward and outward. The maximum amount of downward shift provided by each control corresponds to four scale divisions. Moving the right handle outward to its extreme position therefore will change the apparent location of the dotted line from step 1 to step 5, for example, from 6 to above 9, etc. Moving the left control handle outward to its extreme position similarly will change the apparent location of the dotted line from step 5 to step 1, or from step 8 to step 4, etc. The examiner varies the location of the right or left control handle, each time asking the examinee to report the location of the dotted line. Only one of these answers, that is, the answer obtained when both handles are in the scoring position, gives the examinee's score on the test.

(2) Drum Position 2, Far Lateral Phoria (figure 3-2):

(a) The procedure for this test is similar to that for vertical phoria. The standard question is, "TO WHICH NUMBER DOES THE ARROW POINT?" If the examinee says it does not point to any number or is between two numbers, the examiner will ask, "TO WHICH NUMBER IS IT CLOSEST?" If the examinee does not see the arrow or does not see the numbers, the procedure will be as described in the previous test. If the examinee says that the arrow moves over a wide range, the examiner will say, "LOOK CLOSELY AT THE CHECKER-



TEST 1—FAR VERTICAL PHORIA



TEST 2—FAR LATERAL PHORIA

Figure 3-2. Far Phoria Tests.

BOARD PATTERN OF THE ARROW." If the arrow continues to move, the examiner will cover and then uncover the right eye with the occluder, saying, "LOOK CLOSELY AT THE ARROW." "TELL ME WHERE IT IS WHEN YOU FIRST SEE THE NUMBERED DOTS." The test will be discontinued if the examinee cannot see both the arrow and the numbers at the same time. Failure to see either the arrow or the numbers will be scored X as in the previous test. The instrument score is the number (1 through 21) that the examinee answers. The score is zero if the arrow is pointing to the left of 1. The score is 22 if the arrow is to the right of 21. Caution: If the examinee answers that the arrow "points to the second one," the examiner should verify that he means the dot between number 1 and number 3.

(b) Detection of Malingers. By means of the variable prism previously mentioned the right and left eye images can both be shifted outward a maximum of seven dots. To produce this outward shift without a downward shift, in this test both control handles will be moved outward simultaneously the same distance. When both handles are moved as far out as they go, the apparent position of the arrow is moved seven dots to the left giving a score seven below the true score. As in the previous test, the correct score and the only score recorded will be that obtained when the control handles are in the scoring position. That is when both are pushed inward as far as they wil go.

(3) Drum Positions 3 and 4 or 3A and 4A, Far

Acuity (figure 3-3):

(a) In this test the examiner must remember to occlude the left eye when the right is tested and vice versa, whereas the previous test was given with the occluder in the mid- position. The prism control handles will be in the scoring position. Slide 3 and its alternate, slide 3A, contain the smaller letters, slide 4 and its alternate 4A, the larger ones. The larger letters are used only if the examinee cannot read correctly seven of the ten largest letters on slide 3 or its alternate, 3A. (Alternate slides are provided in case the examinee has memorized the order of the letters on a line which he cannot actually read.) On slides 3 and 3A, there are 20 letters of each size. Only 10 of the 20 letters of each size need be used. Thus, the examiner may ask the examinee to read lines 5 or 5A, 6 or 6A, etc.

(b) The examiner will say, "READ THE LETTERS ON LINE 5 AT THE TOP OF THE CHART." (Line 5A may be used instead.) If more than three errors are made, the test will continue with the larger letters on slide 4 or slide 4A. If three or less errors are made in line 5 or 5A, the examiner will say, "LOOK AT THE SMALLER LINES OF LETTERS ON THE LEFT AND THE STILL SMALLER ONES ON THE RIGHT. WHAT IS THE SMALLEST LINE YOU CAN READ EASILY?" From this point on the examiner may proceed in any way he wishes to determine the smallest line of letters which the examinee can read with not more than three errors in 10 letters. (TO OBTAIN A SCORE FOR ANY GIVEN LINE OF 10 LETTERS THE EXAMINEE MUST CALL OFF CORRECTLY 7 OR MORE LETTERS IN THAT LINE. ALTERNATELY EXPRESSED THE EXAMINEE WILL BE ALLOWED TO MAKE 3 ERRORS IN ANY LINE OF 10 LETTERS AND STILL RECEIVE THE SCORE FOR THAT LINE.) The examinee's instrument score on this test will be the number of the smallest line of letters on which not more than 3 errors in 10 are made. Only 10 letters of each group need to be used unless the examiner suspects malingering or wishes to verify the examinee's final score by having him read a second 10 letters of the same size.

(c) If the examinee cannot read lines 5 or 5A with three or less errors, the examiner will determine his acuity score using slide 4 or its alternate, slide 4A. There are four sizes of letters on this chart corresponding to instrument scores 1 to 4. The lines are not numbered on this slide. The top line represents a score of 1. The second and third lines from the top represent as score of 2. The fourth lines represents a score of 3 and the bottom line a score of 4. The examiner should have the examinee start with the top line of 3 letters. IF HE MAKES 1 ERROR OR NO ERRORS ON THE TOP LINE, HE CONTINUES WITH THE SMALLER LETTERS UNTIL HE HAS MADE 4 OR MORE ERRORS IN READING THE 10 LETTERS OF A SIZE. (TO OBTAIN A SCORE FOR ANY GIVEN SIZE OF 10 LETTERS THE EXAMINEE MUST CALL OFF CORRECTLY 7 OR MORE LETTERS IN THAT SIZE. ALTERNATELY EXPRESSED THE EXAMINEE WILL BE ALLOWED TO MAKE 3 ERRORS IN ANY SIZE OF 10 LETTERS AND STILL RECEIVE THE SCORE FOR THAT SIZE.) The instrument score is given by the letter size for which not more than 3 errors in 10 are made; an exception is made for the top line of 3 letters, of which two must be read correctly to give a score of 1. If more than 1 error is made, the instrument score is 0.

(4) Drum positions 5 or 5A, Binocular Fusion and Depth Perception (figure 3-4):

(a) Fusion Test. Before giving this test the examiner will make sure that the occluder is in the midposition and the prism control handles are in the scoring position. The purpose of this test is to determine whether the slightly different test targets presented to the right and to the left eye are combined into a single image; they are seen double, that is side by side or one above the other; or the target presented to one eye is not seen.

(b) If the examinee has normal binocular (two-eyed) vision, he will see at the left of the slide a single arrow with both a head and a tail ((1) in figure 3-5). To make sure that the examinee actually has normal binocular vision, the examiner will ask him to describe what he sees, and check the truthfulness of the answers by covering one eye of the examinee with the occluder. When the right eye is covered, the tail of the arrow should disappear. When the left eye is covered, the head of the arrow should disappear. If either of the following abnormal answers are given when the examinee is allowed to use both eyes (occluder not over either eye), the examiner will count the fusion test as failed.

1. Double Vision. The examinee reports that he sees two arrows side by side as in (2) in figure 3-5, or that he sees two circles, one above the other as in (3) in figure 3-5. Before failing examinee the examiner will check to see that prisms are in scoring position.

2. Suppression. When allowed to use both eyes, the examinee sees only the head or only the tail

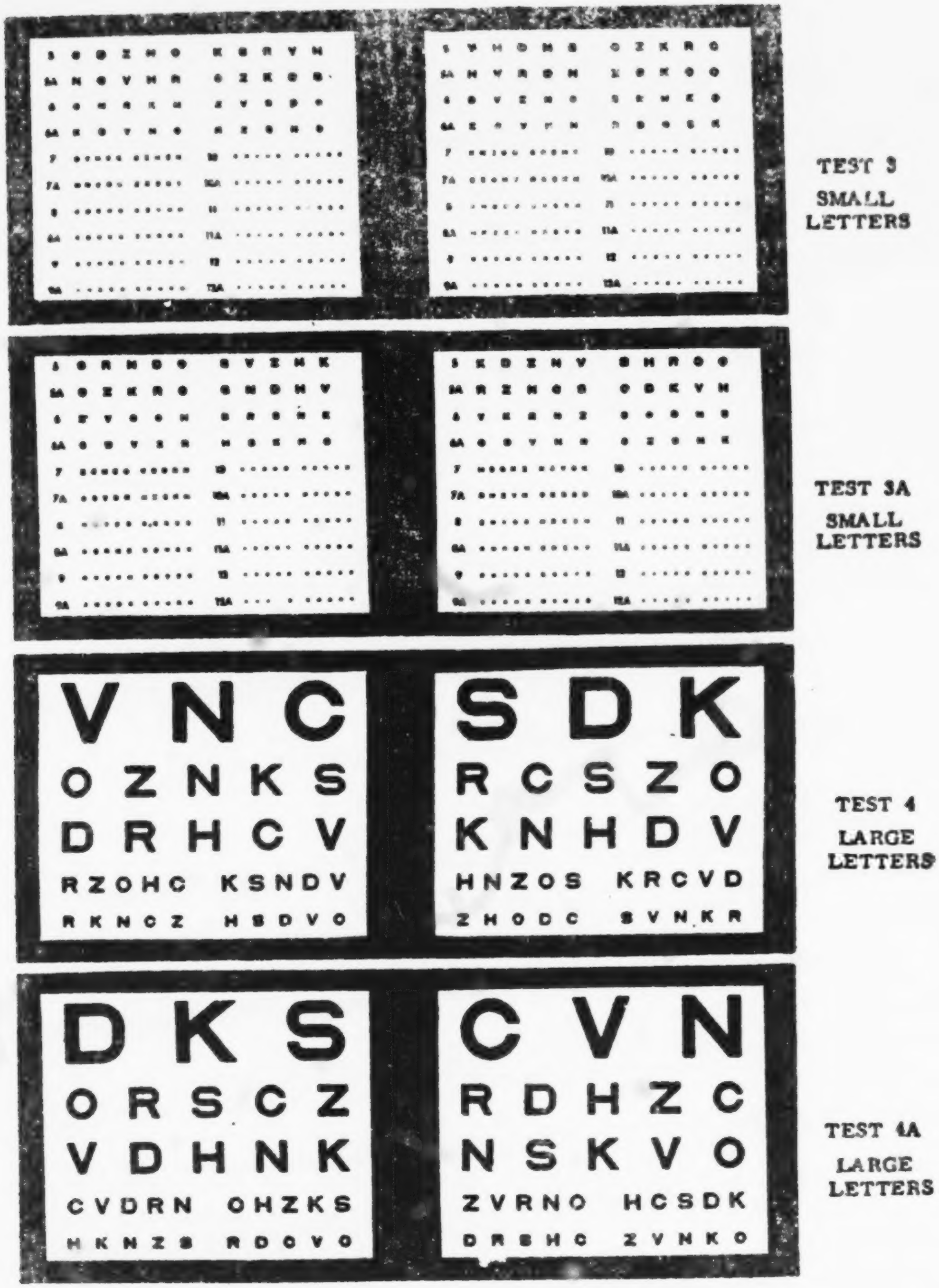

TEST 3
SMALL LETTERS
TEST 3A
SMALL LETTERS
V N C
O Z N K S
D R H C V
R Z O H C K S N D V
R K N C Z H S D V O
S D K
R C S Z O
K N H D V
H N Z O S K R C V D
Z H O D C S V N K R
TEST 4
LARGE LETTERS
D K S
O R S C Z
V D H N K
C V D R N O H Z K S
H K N Z S R D C V O
C V N
R D H Z C
N S K V O
Z V R N O H C S D K
D R S H C Z V N K O
TEST 4A
LARGE LETTERS

Figure 3-3. Far - Letter Acuity.

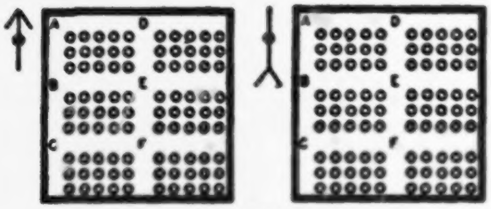
of the arrow (4) in figure 3-5.

(c) Depth Test:

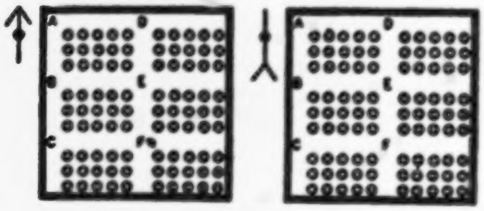
1. This test will be omitted if the examinee fails the fusion test, that is, if he exhibits either double vision or suppression. It will also be omitted if the examinee's score is 0,1,2,3, or 4 on the far-acuity test in either eye. A score of X will be given if the depth test is omitted.

2. In the entire battery of tests that for perception is the most difficult to give and interpret. This is, in part, because examinees who have normal perception of depth in situations to which they are accustomed may have to learn to see the apparent depth employed in this test. Consequently, although good scores can be accepted as evidence of normal binocular vision and normal depth perception, even complete failure on this test, unless supported by other evidence, is not necessarily indicative of poor depth perception. Therefore, to reduce to a minimum the number of "false failures," the examiner should not hurry through the demonstration and the practice period which precede the actual test. The depth slide used to test depth perception consists of a number of horizontal rows of cirlces, five circles in each row, one of which should appear slightly nearer to the examinee than the other four.

3. To explain the test, the examinee will first be shown a demonstration device consisting of a transparent plastic plate with four black circles on the rear surface, one in the front. As in the depth-perception test itself, one circle appears nearer than the other four. After the plastic demonstration model of the test has been shown, the examinee will be told to look into the instrument and his attention directed to group A, the three rows of circles in the upper left-hand corner of the square. The first group will be used to further explain the test and allow time for the perception of depth to develop. The top row of five circles in group A demonstrates a relatively large difference in depth, the middle row a moderate difference, the bottom row a small difference. Some examinee may not see any depth for the first minute or so, and in such cases the examiner must not hurry through the practice test. He may tell the examinee the correct answers to the three rows of group A and instruct him to look at each circle in turn until he can see that one of the five circles in each row is nearer to him than the others.



TEST 5



TEST 5A

Figure 3-4. Fusion and Depth Perception.

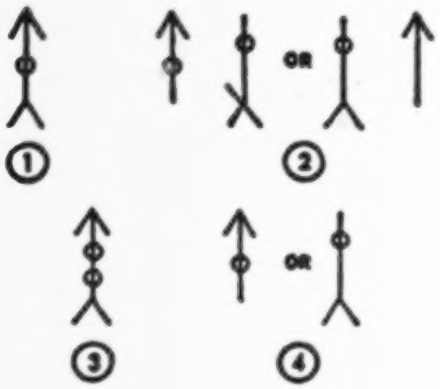


Figure 3-5. Binocular Vision Tests.

4. The examiner may use the occluder to demonstrate that with monocular (one-eyed) vision all the circles appear in the same plane, while with binocular (two-eyed) vision one may appear nearer than the other four. When the examiner is satisfied that the examinee actually sees depth in at least the top row, he may proceed to the actual test. This will be given without any help or hints from the examiner such as are used in the practice period. The examinee will be asked to indicate by number, counting from

left to right, which circle is nearer in the top, the middle, and the bottom row of group B. If all three answers are correct, the same questions will be asked for group C, group D, etc. The test will be discontinued when the examinee gives one or more incorrect answers in any one group beyond group B. (If one or more incorrect answers are given in group B, the examiner will repeat the practice session with group A, then have the examinee try group B again, followed by group C, etc., if correct answers are now given in Group B.) The score will be the letter of the last group in which no errors are made. If the first test group B is failed a second time, the score will be recorded as zero.

(5) Drum position 6, near vertical phoria (figure 3-6): The procedure for administering the near phoria test is the same as the procedure described above for the far vertical phoria test.

(6) Drum Position 7, Near Lateral Phoria (figure 3-6): The procedure is the same for the far lateral phoria test.

(7) Drum Positions 8 and 9, Near Acuity (figure 3-7): The procedure is the same as for the far acuity test.

(8) Acuity Test for Illiterates (figure 3-8):

(a) Measurement of the Visual Acuity of Illiterate Examinees. A slide for measuring the distant acuity of illiterate examinees may be substituted for one of the other acuity slides. This slide contains broken rings resembling the letter C, turned so that the opening is in one of the four directions, up, down, right, or left. There are seven different sizes of the broken ring character on the illiterate slide numbered 1, 2, 3, 4, 6, 7, and 9 on the scoring key. These lines are not numbered on the slide. In this test lines will not be skipped. The examinee will be required to read every line, starting with the large rings at the top and proceeding to successively smaller lines. As in the letter test, the instrument score will be the number of the lowest line on which breaks in at least seven of ten rings are correctly located.

(b) Right Eye Tested First. The occluder will be placed in front of the left eye and the prism control handles in the scoring position. The standard questions are, "DO YOU SEE THE THREE LARGE CIRCLES AT THE TOP? EACH CIRCLE HAS AN OPENING IN IT. WHERE IS THE OPENING IN THE FIRST ONE? IN THE SECOND? IN THE THIRD?" It may be necessary to raise the lid and point to individual rings to insure an accurate test. If the examinee appears to confuse right and left in reporting the location of the breaks, the examiner will ask him to begin the line again saying, "TELL ME WHETHER THE OPENINGS ARE AT THE TOP, AT THE BOTTOM, ON THE SIDE TOWARD ME (touching examinee's right arm), OR ON THE OTHER SIDE." If right and left are still confused, the examiner will substitute hand signals with examinee pointing in direction of openings on either side. Examiner will test on each successive line until one is failed. The left eye will be tested the same way (Examiner will change the occluder.)

(c) Instrument Score. Key score number for the last line passed will be recorded. On line 1 a passing score requires correct identification of the breaks of two of the three rings. Line 2 requires identification of three of the five rings. The remaining lines contain 10 rings and are failed if more than 3 are not identified correctly.

(9) Binocular Acuity Test (figure 3-9). Slides for distant or near binocular acuity are available and the procedure will be the same as for monocular vision except that the occluder is kept in the midposition.

(10) Summary, Questions, and Scoring:

(a) Distance Tests:

1. F-1 Vertical phoria far—Occluder in midposition.

Question—"DO YOU SEE A WHITE DOTTED LINE? DO YOU SEE A ROW OF NUMBERED STAIRSTEPS? WHERE IS THE DOTTED LINE IN RELATION TO THE NUMBERED STEPS?"

Instrument score is the number (1-9) given with prism handles in scoring position. If below step 1, record zero; above step 9, 10 is recorded. If both steps and dotted line are not seen at the same time, X is recorded.

2. F-2 Lateral phoria far—Occluder in midposition.

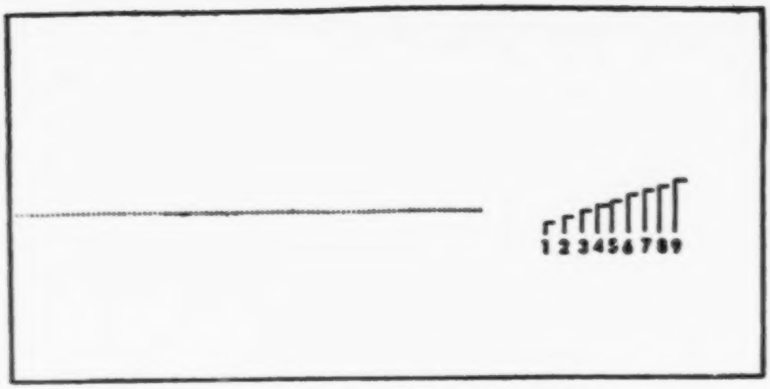
Question—"TO WHICH NUMBER DOES THE ARROW POINT?"

Instrument score is the number (1-21) given with prism handles in scoring position. If arrow points to left of 1, the score is zero; to right of 21, the score is 22. If arrow and numbered dots are not seen at the same time, X is recorded.

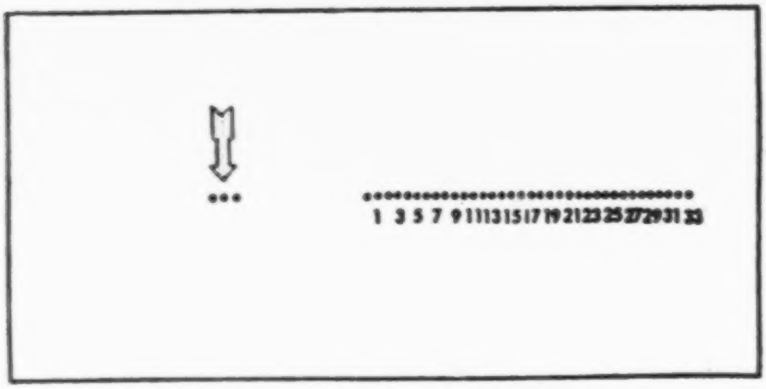
3. F-3 (Or 3A alternate slide, scored the same) Far letter acuity (small letters)—Occluder before eye not being tested, prism handles in scoring position. Examiner will test first right eye, then left eye.

Question—"READ THE LETTERS ON LINE 5 AT THE TOP OF THE CHART."

If three or less errors are made:



TEST 6 – NEAR VERTICAL PHORIA



TEST 7 – NEAR LATERAL PHORIA

Figure 3-6. Near Phoria Tests.

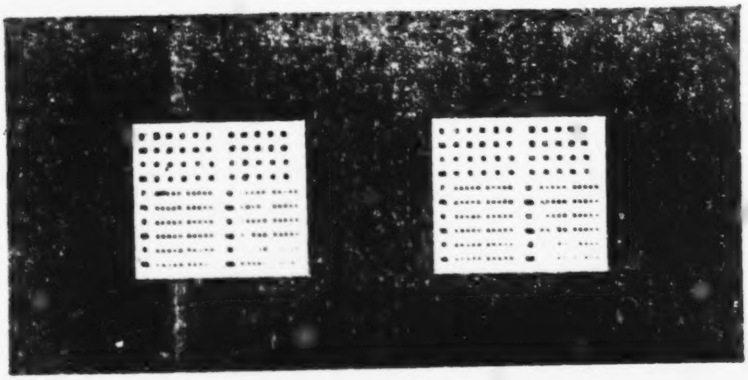
"LOOK AT THE SMALLER LINES OF LETTERS ON THE LEFT AND THE STILL SMALLER ONES ON THE RIGHT. WHAT IS THE SMALLEST LINE YOU CAN READ EASILY?"

Examiner will continue testing to determine smallest line which examinee can read with not more than three errors in line of ten. Both right and left eye will be tested. Instrument score is the number of the smallest line read with not more than three errors.

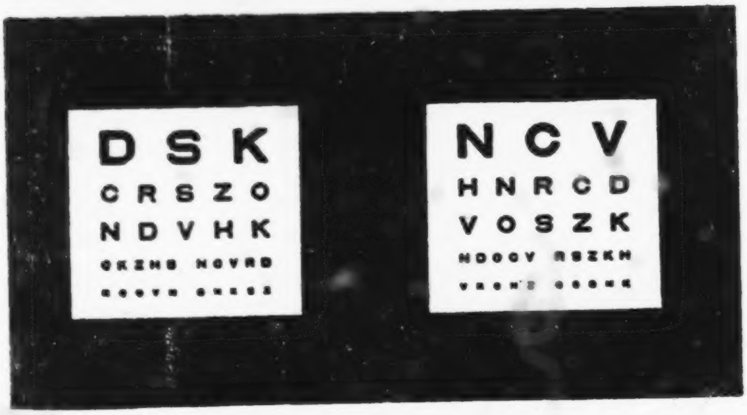
4. F-4 (Or 4A alternate slide, scored the same) Far letter acuity (large letters)—Occluder before eye not being tested. If examinee cannot read line 5 in F-3 or F-3a with 3 or less errors for either ight or left eye examiner will use this slide starting with largest letters and continuing until examinee fails one size of letters. If a score on F-3 or F-3a has been obtained for one eye, examiner will test only the failing eye on slide F-4 or F-4a.

Instrument score will be 1 if examinee can read two of the three largest letters, but misses more than three of the next size. Otherwise the score will be the scoring key number of the smallest size of 10 letters on which no more than three errors are made. These are alternate slides for F-3 and F-4 and will be administered and scored in the same manner.

5. F-5 (Or 5A alternate slide scored the same) Binocular fusion and depth perception—occluder in midposition. Prism control handles in scor-

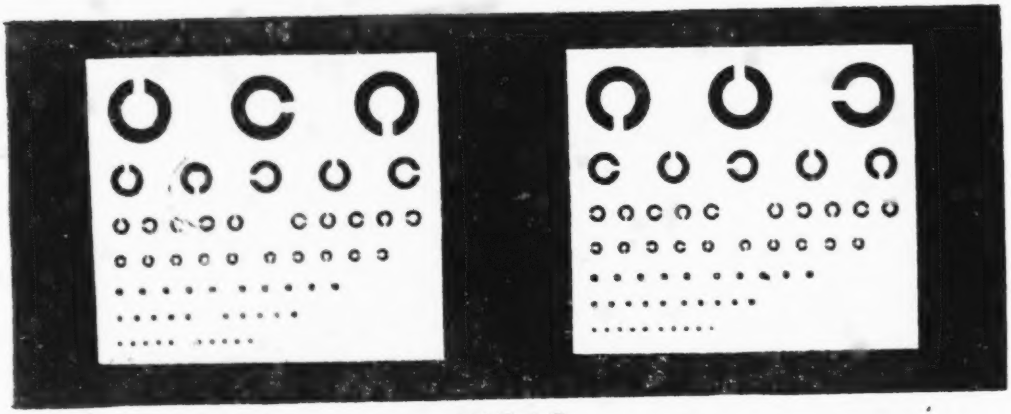


TEST 8 – SMALL LETTERS


D S K
C R S Z O
N D V H K
N C V
H N R C D
V O S Z K

TEST 9 – LARGE LETTERS

Figure 3-7. Near Letter Acuity.



TEST 4–S

Figure 3-8. Far Ring Acuity - Illiterates.

ing position.

Fusion Test

Question—"DO YOU SEE A LARGE SQUARE CONTAINING LETTERS AND CIRCLES? TO THE LEFT OF THE SQUARE WHAT DO YOU SEE? DESCRIBE IT."

Examiner should make certain examinee sees both head and tail of arrow with a single shaft passing through the circle.

Right eye is occluded.

Question—"WHAT DO YOU SEE NOW?"

Examinee should see only head of arrow.

Left eye is occluded.

Question—"WHAT DO YOU SEE NOW?"

Examinee should see only tail of arrow. If examinee does not pass the fusion test, depth test will be omitted and depth score recorded as X.

Depth Test

If examinee passes fusion test, examiner will continue with depth test—occluder in midposition.

Question—"WILL YOU LOOK IN THIS DIRECTION? THIS NEXT TEST WILL SHOW GROUPS OF CIRCLES LIKE THIS." (Demonstrator will be presented with slide which has single circle toward examinee.) "DO YOU SEE THAT THIS CIRCLE (point) IS CLOSER TO YOU THAN THE OTHERS? LOOK INTO THE INSTRUMENT AGAIN. IN GROUP A, LOOK AT THE TOP ROW OF CIRCLES. WHICH CIRCLE IS CLOSER TO YOU (COUNTING ACROSS THE ROW FROM THE A)?"

If the examinee does not answer immediately examiner will give him clues including the proper answer to this row, and rows 2 and 3 of group A. Making certain examinee keeps both eyes open, examiner continues with group B through F until one of the three lines in a group is failed. If examinee fails group B, training group A will be repeated and the examinee will test a second time in group B, continuing with the remainder of test if group B is passed.

Instrument score is zero if group B is failed the second time. Otherwise the examiner records the better score of the last group in which no errors are made.

(b) Near Tests. After the depth test the near point tests will be given, using the slides in the front drum. The examinee remains in position at the instrument and the examiner drops the viewing box to the near testing position, saying, "KEEP YOUR HEAD IN THE SAME POSITION." If the examinee is wearing bifocals, it may be necessary for him to tilt his head backwards slightly so that he can look through the "reading" portion of his bifocals.

1. N-6 Near vertical phoria—occluder in midposition.

Question—"NOW THE DOTTED LINE IS NEAREST LEVEL WITH WHICH STEP?"

Examiner will check for malingering and score as in F-1.

2. N-7 Near lateral phoria—occluder in midposition.

Question—"NOW THE ARROW POINTS TO WHICH NUMBER?"

Examiner will check for malingering and score as in F-2. Prism handles are then returned to scoring position.

3. N-8 Near letter acuity (small letters) occluder before eye not being tested. Test and score as in F-3 or F-3a.

4. N-9 Near letter acuity (large letters) occluder before eye not being tested. This test will be used if line 5 in N-8 is failed. Examiner will test and score as in F-4 or F-4a.

5. N-10 Space for optional slides.

(c) Illiterate Test:

1. Examiner will make certain occluder is in front of the left eye, prisms control handles in scoring position.

Question—"DO YOU SEE THE THREE LARGE CIRCLES AT THE TOP: EACH CIRCLE HAS AN OPENING IN IT. WHERE IS THE OPENING IN THE FIRST ONE? IN THE SECOND? IN THE THIRD?"

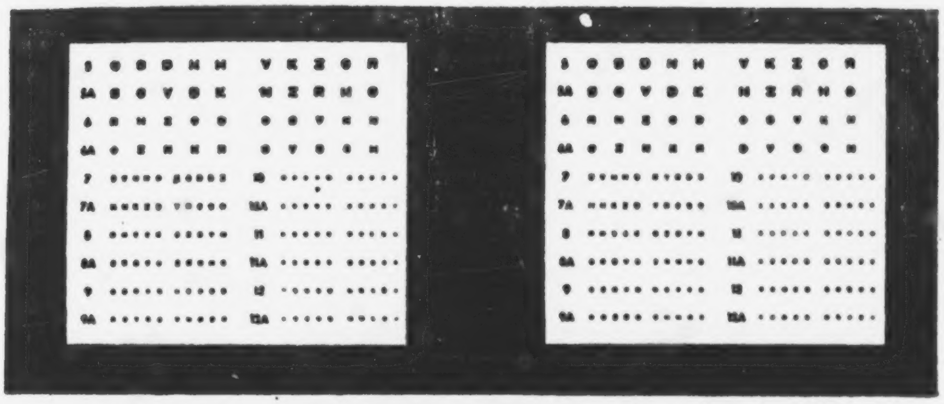
2. Instrument Score. Examiner will record the answer key score number for the last line passed. On line 1 a passing score requires correct identification of two of the three rings. Line 2 requires identification of three of the five rings. The remaining lines contain 10 characters and are passed if 7 of the 10 are correctly identified.

(d) Binocular Acuity. Occluder in mid-position—prisms in scoring position.

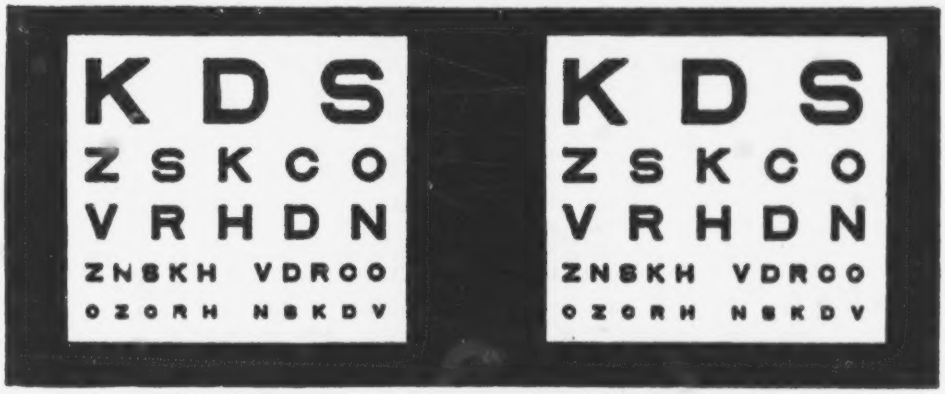
(e) Scoring Key. (See tables 3-2 and 3-3.) The tests are administered and scored in the same manner as the monocular acuity tests.

3-5. Distance Vision:

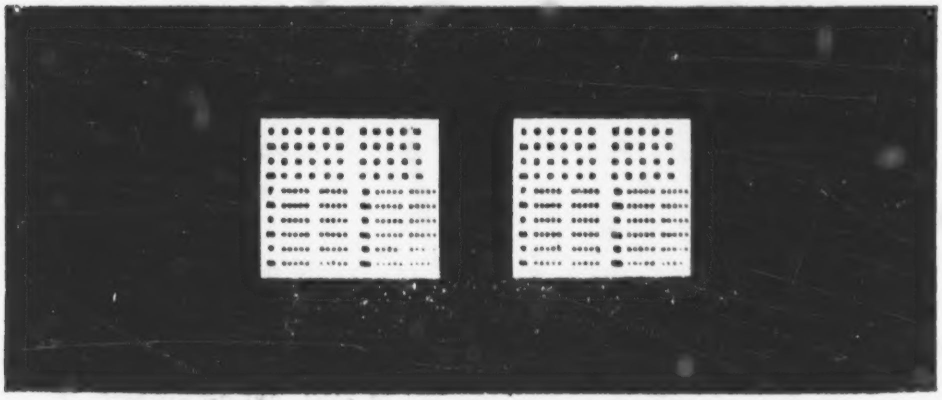
a. Procedure. If the VTA-ND is not available for vision testing, the following method will be used:



TEST NS 1 FAR BINOCULAR LETTER ACUITY (SMALL LETTERS)


K D S
Z S K C O
V R H D N
ZNSKH VDROO
OZORH NSKDV
K D S
Z S K C O
V R H D N
ZNSKH VDROO
OZORH NSKDV

TEST NS 2 FAR BINOCULAR LETTER ACUITY (LARGE LETTERS)



TEST NS 3 NEAR BINOCULAR LETTER ACUITY (SMALL LETTERS)

Figure 3-9. Binocular Acuity.

SCORING KEY, VISION TEST APPARATUS, NEAR AND DISTANT VISION TESTING

FAR TESTS					
Score		Test 3—Small letters		Test 3A—Small letters	
		Left eye	Right eye	Left eye	Right eye
20/50 20/40	5 5A 6 6A	CDZNO KSRVH NCVHR OZKDS CNRKH ZVSDO KDVHO RZSNC	VHDNS OZKRC HVRDN ZSKCO DVZNC SRHKO SCVHN RDOSK	CRNDO SVZHK OSKRC SNDHV ZVOCH DRSNK ODVZR HSKNC	KDZNV SHROC RZNCS ODKVH VKRNZ CODHS ODVNR CSZHK
20/30 20/25 20/20	7 7A 8 8A 9 9A	DVHCK OSNZR HNCDO ZKSRV CDKRO SZVNH CDSVO ZHRNK CVHSZ ORKDN VHOKC SRNZD	KNZCO SRDHV DZONV RCSKH KNDRS ZVCOH HKZSC NROVD VZCHD KNRSO CKROH SDZNV	ZKHSO VCDRN OCVDR HZSKN HNVZS CKRDO OSRNZ CDHKV RHCVN ODSZK ZHODC SVNKR	HSDRZ NCVOK RNZVH OKSCD ZOVCK NRKDH KNROH SDZCV RHSDK ONCVZ OSCHN RVKZD
20/17 20/15 20/13	10 10A 11 11A 12 12A	DNVHS OKRCZ ZDVOH CRSKN ZHODC SVNKR VDKHO RSZNC KHOZD CSNVR ZVSDO CHNRK	KZSVN HCRDO ZHRSN OKVDC RCSNV KDHOZ VDHON RCKZS ROKHZ NSCVD CRNDO SZVKH	KRNHC OSDVZ NDZOC HVKSR SCHZD VKNRO VDNSK ZHCOR CNDZK OHRVS HOCVZ SRNKD	KNRSD OHVCS RKCVN OSDZH KZODR HNSCV ZDCKN SVRHO RVNSZ KCDOH CSNDO HRVKZ
		Test 4—Large letters		Test 4A—Large letters	
		Left eye	Right eye	Left eye	Right eye
20/400 20/200 20/100 20/70	1 2 2 3 4	VNC OZNKS DRHCV RZOHC KSNDV RKNCZ HSDVO	SDK RCSZO KNHDV HNZOS KRCVD ZHODC SVNKR	DKS ORSCZ VDHNK CVDRN OHKZS HKNZS RDCVO	CNV RDHSC NSKVO SVRNO HCSDK DRSHC ZVNKO

Test 5—Depth	Test 5A—Depth	Score		Test 6—E	Illiterate
				Left eye	Right eye
A B C D E F 3 4 2 4 2 3 2 3 4 2 4 3 4 4 2 3 3 2	A B C D E F* 3 3 4 3 2 3 2 4 2 2 3 2 4 2 4 3 4 3	20/400 20/200 20/100 20/70 20/40 20/30 20/20	1 2 3 4 6 7 9	URD UDLUR ULDLU RURDL RUDRU DLDRL UDRLD LRDLU RULDL URUDL LUDLR DUDRL	DUL RULUD LRRDR ULDRU LDLRU DURLU DLRDR UDRLU RUDRU DLURL URLUD ULDRL

TABLE 3-2.

SCORING KEY, VISION TEST APPARATUS, NEAR AND DISTANT VISION TESTING

Score		NEAR TESTS		BINOCULAR ACUITY	
		Test 8—Small letters		Small letters	
		Left eye	Right eye	Test NS—3 near	Test NS—1 far
20/50	5	ZKCRV OHSDN	CVRZS DKHNO	OCVKR ZNSDH	OSDNH VKZCR
	5A	ORSNK VHDZC	OZRCV SKNDH	SDOVH CNZKR	SCVDK NZRHO
20/40	6	SDKVO ZRHNC	VZKCO HRSDN	ZHOCV NDRKS	RHZCD OSVKN
	6A	ZODVN HKSCR	NZCKO DSRHV	VNCSO KDZRH	OZNKR DVSCH
20/30	7	DHZRV SOKNC	HSZKN OVCDR	SDOVK HRNZC	SVNHO KCRDZ
	7A	NCKSR HZDVO	NRDVC ZKHOS	ZOHRC KDSNV	HNKZD VRCSO
20/25	8	DKOSN RVZCH	OVRHS CNDZK	DNHKO ZSRVC	RHSCK OZDVN
	8A	CKDSV OZNHR	VCHRD SKNZO	NSOZR VHKDC	CKDVO ZRNHS
20/20	9	KRZVD OSNCH	ZHCOR VDNSK	DSVKH ZNOCR	OZRVN HSCKD
	9A	VDOKH RZSCN	HVRSK ZODNC	NZOSR DVHCK	KDZRO VNHSC
20/17	10	OKSRN DHVCZ	RHCVN SDKZO	NZHKO RCVDS	DRHVN ZSKCO
	10A	HOVNC RZDSK	KRNHC DOSVZ	DNKOZ HSRVC	ZDSKC ORHNV
20/15	11	VRCHN OZKSD	CNZSR OHKDV	SNCZO RKVHD	OSKCV RZHDN
	11A	SVRNO CHZDK	DCVHK NOZSR	OCVNS DZKRH	CSHRV KNDZO
20/12	12	ROHKS VDNCZ	ODCNH VRSKZ	DHNVO SCZKR	SKHDN OCVRZ
	12A	KHRCV OSDNZ	RKCDO HVNZS	CNHRD OKSZV	KRSZC HNVDO
		Test 9—Large letters		Large letters	
		Left eye	Right eye	Test NS—4, near	Test NS—4, far
20/400	1	DSK	NVC	NVC	KDS
20/200	2	CRSZO	HNRCD	CZHSN	ZSKCO
	2	NDVHK	VOSZK	DKORV	VRHDN
20/100	3	OKZHS NCVRD	NDOCV RSZKH	KSDVO NHZCR	ZNSKH VDRCO
20/70	4	RCOVN DHKSZ	VRCNA OSDHK	VZOCS HRNKD	OZCRH NSKDV

INTERPRETATION OF PHORIA SCORES—FAR AND NEAR

Tests 1 and 6

Score	1	2	3	4	5	6	7	8	9
Prism Diopters	2.0	1.5	1.0	0.5	0	0.5	1.0	1.5	2.0
	Left hyperphoria						Right hyperphoria		

Test 2

An instrument score of 11 indicates orthophoria. If instrument score is greater than 11, that amount greater indicates prism diopters of exophoria. If instrument score is less than 11, that amount less indicates prism diopters of esophoria.

Test 7

An instrument score of 13 indicates orthophoria. If instrument score is greater than 13, that amount greater indicates prism diopters of exophoria. If the instrument score is less than 13, that amount less indicates prism diopters of espohoria.

TABLE 3-3.

(1) If the examinee wears glasses, they must be removed before he enters the examining room. Each man will be tested without unnecessary delay after he has entered the room. To prevent personnel from memorizing the charts, only one examinee will be permitted to view the targets at a time. Personnel awaiting the test must be kept out of hearing.

(2) The examinee will be directed to the indicated 20-foot mark. The examiner will hold the occluder and cover the examinee's left eye, while instructing him to keep both eyes open without squinting. The occluder must not be permitted to touch any part of the eye to be shielded, but should be held in contact with the side of the nose.

(3) The examinee will be directed to begin with the first visible line and to read as many lines as possible. (The larger and less used lines should be kept covered.)

(4) The smallest line read on the chart from the 20-foot distance will be recorded as the vision for the right eye.

(5) The acuity for the left eye will then be tested, using a different chart and recording the same manner.

(6) Finally, the visual acuity for both eyes may be taken, if desired, with a third chart and recorded.

(7) A person who normally wears glasses all the time will be tested again with them in place. The same procedure will be followed as without glasses, for right eye, left eye, and both eyes, changing charts for each test.

(8) When there is suspicion that the examinee has memorized the charts, he will be directed to read the letters or targets in reverse order or will be shown a different chart. When suspicion still remains, further check for malingering will be done as outlined elsewhere in this Manual.

(9) The examinee is expected to read the letters promptly. No precise time limit should be applied but one or two seconds for each letter is ample time.

(10) When an examinee fails a letter or target, he should not be asked to read it again. If the examinee is a rapid reader and his mistakes are obviously careless ones, he should be cautioned to "slow down" and the test should be repeated on another chart.

(11) Some men give up easily. They may need encouragement to do their best. However no coaching will be given by the examiner.

b. Score Recording:

(1) Vision will be recorded in the form of a fraction, but in round numbers, that is 20/20, 20/40, not 20/20 +2, or 20/40 -3. The upper number is the distance in feet from the targets, and the lower number is the value of the smallest test chart line read correctly. Thus, a person reading the 30-foot test chart line at a distance of 20 feet is given a score of 20/30; 20/20 indicates that a person reads the test chart line marked 20 at a distance of 20 feet. Similarly, 20/200 means that a person can read only the test chart line marked 200 from a distance of 20 feet.

(2) When glasses are worn, the vision will be recorded both with and without glasses.

(3) Vision test charts vary from set to set in the number of letters per line. Therefore, in general, requirements establishing a specific visual acuity score will be so that the examinee must read correctly approximately 75 percent of the letters on a given line; e.g., if the 20/70 line has ten letters on the line, the examinee must read seven of these ten letters; if the 20/100 has four letters on the line, the examinee must read correctly three of the four letters to attain a score of 20/100.

c. Suggested Useful Phrases for the Examiner:

(1) "Please stand here (indicating the place). Hold your head still and straight. Keep both eyes open when I cover your left eye."

(2) "When I cover eye, don't close it, for that interferes with the test."

(3) "Start at the top and read as many lines as you can."

(4) "Don't squint. Don't screw up your eyelids or frown."

(5) "Look straight ahead."

(6) "Don't rub your eyes."

(7) "Read promptly—too much effort will tire your eyes and make it harder to read."

(8) "Don't hurry; get each one right that you can because you won't have another chance."

(9) "The next line may be hard but try it anyway."

(10) "If you're not quite sure, make a guess; play your hunches."

d. Precautions To Observe in Conducting Tests for Visual Acuity:

(1) An accurate measure of visual acuity may be difficult to obtain. The examiner must bear in mind that some men anxious to pass tests will resort to deception. Similarly, other men may take any means to fail a visual test when undesirable duties are in prospect. The examiner must be prepared to face either possibility and to recognize visual defects without cooperation. If the examiner is not a medical officer, questionable examinees should be referred to

one. Various tests for malingering are described under Visual Test for the Detection of Malingers. See paragraph 3-15.

(2) The examiner will watch the person being examined, not the chart which he is reading. The occluder must be held in such a manner that the examinee cannot see around it. The most frequently used method of increasing visual acuity is to squint with the eyelids. This will not be permitted. Some persons with astigmatism will be able to read the letters better by tilting the head to one side; the examinee should not be permitted to do this.

(3) Another well-known method used to pass a test for visual acuity is to obtain eye drops beforehand which contract the pupil. If the pupils are unusually small, the attention of a medical officer will be called to the fact. A thorough search must be made to assure that the individual is not wearing corneal or contact lenses.

(4) The occluder must not be pressed against the globe or lids, but rather it should be held against the side of the nose. The eye shielded by the occluder should be open in order to avoid pressure and to make squinting more difficult.

(5) Some men may appear to be malingering when they are not, and, on the other hand, the most innocent-appearing person may be the worst malinger. If malingering is suspected, the examinee should be referred to a medical officer for additional checks.

e. The Examiner:

(1) The examiner must be neat in uniform and professional in manner.

(2) Test results determine the duties to which personnel will be assigned; therefore, visual acuity must be determined with utmost care.

(3) The examiner must be unhurried and persevering to obtain accurate results. A patient, tolerant, and painstaking attitude on the part of the examiner will reassure examinees and increase the accuracy of the visual acuity test. Haste and irritation must be avoided.

(4) The examiner should undertake to memorize the test targets. If necessary, he may hold in his hand a small card on which the targets are reproduced, in order to verify the responses.

(5) The routine of examination must be followed carefully in the order described. The vision for each eye should be recorded as soon as it is determined so that errors and omissions will be avoided.

f. Retests:

(1) The effects of fatigue and alchohol may make a certain amount of retesting necessary. In questionable cases one retest will be given not sooner than the day after the initial test.

(2) Occasionally an excuse will be given for failure to pass the test because of temporary injury to the eyes. Examples are: That the candidate has gotten something in one or both eyes, that he has been exposed to welding flash, to bright sun, etc. Such cases will be referred to a medical officer.

Exercise 4-1d

1. List, in order of presentation to the patient, the slide number and test name for each of the VIA-ND tests.

2. Which eye sees what target on tests

1

2

5 (fusion)

6

7

3. Concerning Test 1, each step indicates ________________________ prism diopters of hyperphoria, therefore, a response of "7" indicates ____.

4. Concerning Test 2, an instrument score of 5 indicates ____.

5. Which slides and which lines of letters represents 20/20 farpoint acuity?

6. A patient reads 7 letters correctly on line 8, farpoint acuity; how will you record this on an SF 88?

7. When will you omit the stereopsis test, and how will you record this omission?

AMPLITUDE OF ACCOMMODATION

OBJECTIVE

Given the necessary materials and an instructor selected patient, perform the amplitude of accommodation test with no more than one instructor assist.

Accommodation is the process of "focusing" from one distance to another. When we look at a near object, our ciliary bodies constrict, releasing tension on the Zonules of Zinn, and the lens assumes a more convex shape. This is known as positive relative accommodation because it adds positive (+) power to the optical system of the eye. When we look from a near object to a more distant one, the ciliary sphincter relaxes, stretching the crystalline lens into a less convex shape. This is called negative relative accommodation. As long as you remember that positive accommodation adds + power to the eye's optical system, you won't get confused.

In the case of an emmetropic eye (i.e., an eye with no refractive error), no accommodation is required to view clearly an object located at distance. (Note: The term "distance" refers to clinical infinity. Clinical infinity is a distance of 20 feet or greater.) As an object is brought closer and closer to an eye, the eye is required to add more and more plus (+) power into its optical system in order to continue to see details of the object clearly. This is because light coming to the eye from points closer than infinity is a (-) or diverging wave front. To overcome this, the crystalline lens increases in convexity (plus power). Although there are evidently other stimuli to accommodation, a blurred image on the retina seems to be one of the most important reasons an eye is stimulated to accommodate.

The maximum amount of accommodation which an eye can produce is called the amplitude of accommodation. This is measured by determing the nearest distance, converted to diopters, at which a test object can still be recognized.

Due to the fact that the myopic eye is too powerful, the amplitude of accommodation is artifically greater in the myope than the emmetrope. The reverse is true for the hyperope where the amplitude is artificially lower due to the already weak eye.

The amplitude of accommodation may be influenced by many things, but the largest factor is age. Accurate measurements have shown that the average amplitude of accommodation of 10 year olds is about 14.00 D. By the age 70, the amplitude has dropped to 0.25 D.

When individuals reach an age where they can no longer accommodate at their normal reading distance, they may be able to "gain" a little bit by holding their reading material out at arm's length. You will frequently see patients who will express their chief complaint as "my arm's are getting too short." A patient with this chief complaint is really telling you that their accommodation is receding because of their decreasing amplitude of accommodation. In most cases this symptom is a result of a normal aging process, and it will tend to worsen noticeably for several years after its onset. We call this condition presbyopia.

Presbyopia usually has its onset about the age of 40, although, as we stated before, amplitude of accommodation actually begins to decrease at a much earlier age. The correction for presbyopia involves replacing the "lost" plus (+) power of the eye by spectacles or so-called "reading glasses." If the patient is already wearing an Rx for distance vision (or is in need of one), it is necessary to provide the extra plus (+) power needed at near in the form of bifocal lenses.

Figure 2 shows the decline in amplitude of accommodation that occurs with age. As you can see, presbyopia will advance with age whether or not the patient wears glasses. Therefore, the theory that glasses made the eyes worse is in error.

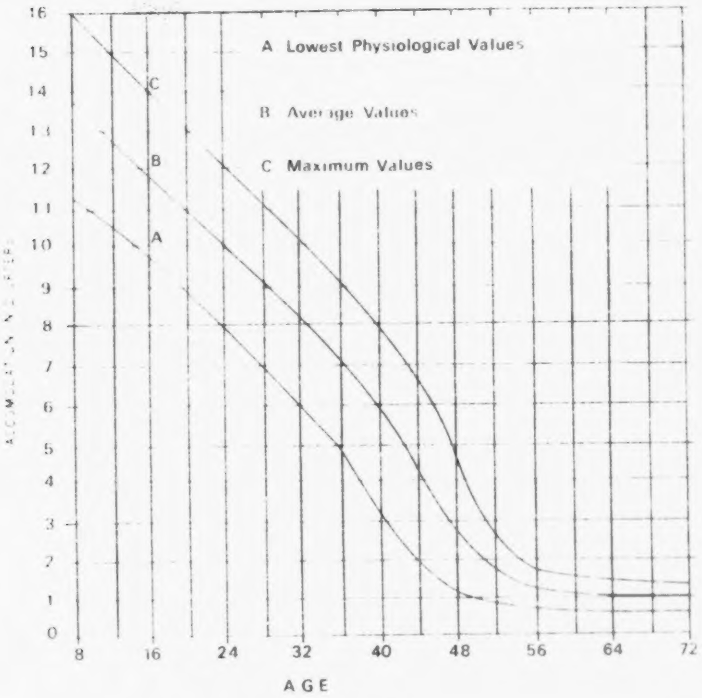


Figure 2

Measuring Amplitude of Accommodation

There are several ways to measure a patient's amplitude of accommodation. As an optometry technician, you may be required to conduct a test called "Nearpoint of Accommodation." This test is conducted during the flying Class I and 1A physical examinations. The results of the test are recorded in the appropriate order under Item 63 of SF 88. The test is administered with the aid of a Prince Rule and an accommodation card. The zero point on the rule should be placed 15 mm from the cornea. The accommodation card should be placed so near to the eye that the examinee cannot read it. Then slowly move the card away from the patient's eye until he/she can correctly read print having a height of 1mm (.62 M or J2). The distance from the eye can be read from the Prince Rule in diopters of accommodation and recorded. Lighting should be good. The test should then be repeated for the other eye. If a Prince Rule is not available, use the formula D = 1/f(m) to find dioptric values. Since most measurements will be in either millimeters (mm) or inches, you can divide 1000 by the nearpoint in mm or divide 40 by the nearpoint in inches. If the examinee has correcting distance spectacles, these will be worn while nearpoint of accommodation is being determined.

AFR 160-43 has a table of accommodative powers which are are expected as minimum values for given ages. Examinees required to take the nearpoint of accommodation test as part of their physical examination will be qualified on the basis of this table of minimum values. The following values are extracted from AFR 160-43.

AGE	DIOPTERS	AGE	DIOPTERS
17	8.8	32	5.1
18	8.6	33	4.9
19	8.4	34	4.6
20	8.1	35	4.3
21	7.9	36	4.0
22	7.7	37	3.7
23	7.5	38	3.4
24	7.2	39	3.1
25	6.9	40	2.8
26	6.7	41	2.4
27	6.5	42	2.0
28	6.2	43	1.5
29	6.0	44	1.0
30	5.7	45	0.6
31	5.4		

You should note that the above values are not meant to correspond with those on the graph in Figure 2. Although it is easy to see a similar relationship between the minimum values of accommodation the Air Force has established for examinees and their age.

By this time you are probably wondering what causes the decrease in accommodation values with age. It is generally agreed that the decline is due to a gradual loss of elasticity in the crystalline lens.

Now read the extract from AFM 160-17, complete your task sheet and the exercise.

3-13. Near Point of Accommodation. A Prince rule and an accommodation card will be used. The zero point on the rule will be placed 15mm. from the cornea. The card will be placed near enough to the eye that the examinee cannot read it and will be slowly moved away until the subject can correctly read print having a vertical height of 1mm. (.62M or J2). The distance from the eye will be read from the Prince rule in diopters of accommodation and recorded. If a Prince rule is not available, diopter values can be computed by dividing the near point in inches into 40 or in centimeters into 100. If examinee wears correcting glasses, these will be worn while near point of accomodation is being determined.

Exercise 4-1e

Answer the following questions in the spaces provided.

1. A patient changes fixation from an object at a distance of 15 feet to another object at 10 feet. Would his eye require more or less plus (+) power with that change?____________________

2. An eye which cannot add plus power to its optical system has zero amplitude of ____________

3. ____________________has its onset about the age of 40.

4. A ruler marked only in centimeters and millimeters is used to measure a patient's amplitude of accommodation. The test card has print 1 mm high and the patient read it correctly first at 100 mm with the O.D. and at 120 mm with the O.S. What is his/her amplitude of accommodation in diopters?

O.D.____________________

O.S.____________________

5. A 21 year old examinee is taking a Class I flying physical. According to the table of minimum values, is he/she qualified if his/her amplitude of accommodation is O.D. 7.5 D and O.S. 7.7 D?

____

6. How much accommodation is required for an emmetropic eye to see clearly at a distance of 16 inches? ____________________ How much accommodation is required by a 1.00 diopter hyperope to see clearly at 16 inches?____________________How much accommodation is required by a 1.00 diopter myope to see clearly at 16 inches? ____________________

NEARPOINT OF CONVERGENCE TEST

OBJECTIVE

Given the necessary materials and an instructor selected patient, measure the near point of convergence with no more than one instructor assist.

The last muscle test which you will learn is called the Nearpoint of Convergence or NPC. This test determines how close to the eyes an object may be brought before the patient either sees double(diplopia) or stops converging (turning in or crossing) his/her eyes.

With the patient seated before you,as in the last test, have him/her fixate a small target 24" to 30" away. (This test is invalid for most tropes.) Slowly and smoothly move the target toward the patient's eyes. The patient's eyes should converge with the inward movement of the target until a point of maximum convergence is reached. At that point the patient should report to you that he/she has begun to see double and you should be able to note a rather sudden divergence of the eyes. When the point of maximum convergence is reached some patients do not let their eyes diverge, but you should notice that additional convergence does not occur and the patient should report seeing double.

The point of maximum convergence is the NPC (or simply PC) and is measured from the bridge of the patient's nose with the aid of a millimeter rule. Record the results as PC ____________________ or NPC ____________________. If the PC measures 50 mm, just record the number of "50"; the units are understood.

Nearpoint of convergence (PC) will be determined for all personnel being examined for flying qualification in classes I, IA and II. Candidates for pilot training will not be allowed to wear corrective lenses while being tested for nearpoint of convergence. With the zero mark of the Prince rule placed approximately 15 mm from the anterior corneal surface, the point of convergence is that point on the rule which marks the greatest convergence of the eyes. It is measured in millimeters. If correcting lenses are necessary to meet the distance or near vision acuity standards, such correction will be worn during this examination. Do not record unit of measurement on item 62, SF 88. A score of 70 or less is considered passing for all flying physicals.

Prolonged repetition usually tires the extraocular muscles and gives erroneous measurements. Before an examinee is disqualified for insufficient power of convergence, he will be examined on two successive days and the nearest point of convergence recorded.

Exercise 4-1f

1. A patient is found to be exotropic on the cover test. Would you perform the near point of convergence test? Explain.

2. How can you tell when you reach the near point of convergence if the patient does not report diplopia?

3. A Score of ________ or less is required to pass the near point of convergence test on flying physicals.

4. The unit of measurement in NPC _______________ is understood and not recorded on the SF 88.

CHARACTERISTICS AND ANOMALIES OF COLOR VISION

OBJECTIVE

Given WS j3ABR91235 000-IV-1q, Identify types of color deficiencies with 70% accuracy.

Characteristic of Color

The sensation of color consists of at least three components completely related to physical characteristics of the stimulus and to the illuminant under which the stimulus is viewed. These components are hue, saturation and brightness. The hue of an object--whether it is red, green, violet, etc.,--is most closely related to the dominant wave-length of the light it emits or reflects; this relationship can be seen when sunlight is split into components of different wavelengths by passing it through a slit and prism. Saturation, the purity of a color, is related to the amount of white light mixed in with the color; it often depends in large part on the type and amount of the illuminant. Chromaticity is a word describing the linkage of hue and saturation which combine to produce what we see and describe as a color. Brightness is related to the rate of transfer of luminous energy-the amplitude or amount of energy reaching our eye. Color is usually specified in terms of all three components. All of these components interact to some extent--for example, a bright red will appear to be of a different hue than a dull red of the same wavelength.

Although there are still many unanswered questions, we have learned quite a bit about human color perception. For instance, we know that cones are the primary color receptors, each cone is selectively sensitive to some wavelengths and not to others, and there are probably "zones" at higher levels in the brain which have a great deal to do with our color perception. In addition, we know that those who have normal color vision all use the same three primary wavelengths (red, yellow and blue or red, green and violet), in about the same amounts, to match all colors.

The split-field anomaloscope is an instrument used for comparing two colors. Each side of the split field has a light source which produces known amounts of red, blue and yellow light (or any three primaries), and each of these primary colors is independently adjustable. First use of these types of instruments was probably to determine the number of hues that an individual can see, and it was found that most people can differentiate 128 separate hues or tints. At the blue-green and yellow portions of the spectrum, the eye can detect a change of as little as a millimicron, but at the red end, 20 mu may be needed to discriminate hue. If saturation as well as hue is varied, the eye may be able to differentiate as many as 500,000 color sensations. Somebody got the bright idea to attempt to match a monochromatic light in one-half of the anomaloscope with a mixture of three primaries, and for most people got fairly consistent results; that is, a mixture of three wavelengths and one side appeared to be the same color as a single wavelength on the other side, and most people thought that both sides were the same color. However, a very small percentage of subjects made "matches" which made no sense to other subjects, one side might appear dark blue and the other side might appear dark red!

Abnormal Color Vision

The person with "normal" color vision is said to be TRICHROMATIC--that is, he/she needs a mixture of three primaries to match any color. There is also a group of trichromats who use the three primaries to make a match but these people use the wrong amounts. For instance, one of these people might use a bright red to match a pink. We call these people PROTANOMALOUS TRICHROMATS (red-weak). There are also DEUTERANOMALOUS TRICHROMATS (green-weak), and TRITANOMALOUS TRICHROMATS (blue-weak). About 5.4% of the population seems to have these problems. Deuteranomalous trichromats are by far the most common.

In addition, there is a group that uses only two primary colors to match all others. We named this group DICHROMATS and they may also be subdivided into three types: PROTANOPES who are red-blind, DEUTERANOPES who are green-blind, and TRITANOPES who are blue-blind. Prontanopes have difficulty discriminating between the longer wavelengths -- red, orange, yellow, and green may all appear to have the same hue -- while deuteranopes can see "green" (but not as trichromats see it). They confuse it with red, orange, and yellow. Tritanopes have trouble with yellow and blue and are extremely rare. About 2.6% of the population seem to have dichromatic vision.

A third group, the only group that is truely color blind, can match any color with only one primary, and these people can use any color as a primary. We call this group MONOCHROMATS and their entire "color" perception consists of blacks, whites, and shades in between. Only about 0.0001% of the population has this problem.

Color defects usually do not change much throughout life. If you have a color defect, you were probably born with it, since most defective color vision is hereditary. The characteristics for color deficiency is carried on the X chromosome. Females have two X chromosomes (XX) while males have an X and a Y chromosome (XY). If you are a female, you got an X chromosome from your mother and an X chromosome from your father. If, on the other hand, you are a male, you got the X chromosome from your mother and the Y chromosome from your father. Whenever a male gets an X chromosome that carries the color defect, or several other defects for that matter, that male has the defect. Females must have the defect on both X chromosomes before they actually have the defect. Generally, females carry the trait as a hidden characteristic on one X chromosome -- and pass these characteristics on to their sons. We call these sex-linked defects and obviously more males have defective color vision than females. (Approximately 8% of males vs only 0.5% of females).

When defective color vision is acquired (not congenital) it is usually pathological and due to some eye disease or systemic condition. Most acquired color deficiencies are of a blue variety whereas red-green deficiencies are usually congenital. A monocular (one-eyed) color deficiency is pathological).

Defective color vision has a wide range of variation from mild anomalous to severe red-green, blue-yellow, and monochromatic defects.

Exercise IV-1g

Complete the Following Statements.

1. The sensation of color consists of at least ____________________ components.
2. Hue is most clearly related to the ____________________ of the light it emits or reflects.
3. Chromaticity describes the linkage of ______________ and ____________________.
4. About 500,000 color sensations can be differentiated by varying ____________________ and ______________
5. A person with normal color vision is said to be ____________________.
6. The most common color deficiency is the deuteranomalous trichromat or ____________________ weak individual.
7. The rarest of all color deficiencies (0.0001% of the population) is the ____________________.
8. Approximately ________ % of males and ________ % females are color deficient.

COLOR VISION TESTING

OBJECTIVE

Given the necessary materials and an instructor selected patient, administer color vision tests with no more than one instructor assist per test.

Several screening tests have been devised to determine who is "color blind" among the population. In the Air Force the standard screening test for color vision is the Vision Test Set, Color Vision (VTS-CV), also called Plate Set, Pseudoisochromatic, 15 plates, NSN 6515-00-299-8186. This set consists of one demonstration plate and 14 test plates in a ring binder. This test must be administered under the easel lamp listed as Light, Color Perception Testing, NSN 6515-00-345-6625. Any other light source alters the colors and renders the test results invalid. Keep in mind that the plates may be rearranged when you suspect the patient is malingering.

If the examinee cannot pass the screening test, he will be tested with the Vision Test Apparatus, Color Threshold Tester (VTA-CTT), NSN 6515-00-388-3700. The purpose of the VTA-CTT is to quantitate the degree of color vision deficiency. A score of 50 or better on the VTA-CTT indicates a mild or Grade 1 deficiency, considered safe for aviation. A score from 35 to 49 indicates a moderate or Grade 2 deficiency, and a score of 34 or less indicates a severe deficiency or Grade 3.

If the examinee passes the screening test, the proper entry for item 64, SF 88, is "VTS-CV Passes." If the examinee does not pass the screening test, enter "VTS-CV Fails/and number of incorrect responses" then enter "VTA-CTT in item 73 of SF 88. Remember to retest the patient with the VTA-CTT if his/her score is within 3 points of 50 or 35.

Congenital color vision deficiency does not change throughout life. Once the degree of color vision deficiency has been established by careful testing, repetition of the testing is unnecessary. The entry "On Record" and the results of previous testing is sufficient, but caution is urged so that invalid test results are not perpetuated.

Air Force Regulations allow the use of a second quantitive test if the VTA-CTT is unavailable. This test is the Farnsworth Lantern (FALANT). The patient is placed eight feet in front of the instrument in a normally lighted room and told he/she will see 2 signal lights, one above the other. The colors may be white, red or green. The patient must name the colors in order, first the top, then the bottom. Start with a red/green or gree/red combination (positions 1 or 5) and expose all 9 signals. If no errors are made, record "FALANT passes" in item73 of SF 88. If any errors are made on the first run, forget that run and perform the test 2 more times (18 exposures). If the patient makes 2 or less errors in these 18 exposures, he still passes, otherwise record "FALANT fails" in item 73 of SF 88.

Now read the AFM 160-17 information on color vision and complete the appropriate task sheets.

The following is extracted from AFM 160-17, 10 July 1972.

3.8 Color Vision:

a. General Color vision does not change except in case of eye or central-nervous-system disease. If a satisfactory test is on record and available, the test need not be repeated on annual or other routine examinations.

b. Screening Test. The standard screening test consists of one demonstration plate and 14 test plates in a ring binder. The standard item, Plate Set, Pseudoisochromatic, 15 Plates, Stock No. 6515-299-8186 will be used.

(1) Light source. The test shall be administered under the easel lamp listed as Light, Color Perception Testing, Stock No. 6515-345-6625.

(2) Procedure:

(a) The easel lamp should be placed on a table or shelf so that the applicant's line of sight is at right angles to the plates and so that his eyes are at a distance of approximately 30 inches (plates just out of arm's reach). The applicant should not face an open window or other strong light. Nearby incandescent lights should be shielded so that they do not illuminate the plates. Nearby window shades should be drawn.

(b) The examiner shall instruct the applicant to "please read the numbers." The examiner shall not give other instructions and shall not ask other questions. The applicant is not allowed to trace the patterns or touch the test plates.

(c) The demonstration plate must be shown first. All of the remaining 14 plates are then shown. About 2 seconds should be allowed for response to each plate. If the applicant hesitates he should be asked again to "read the number"; if he fails to respond, the examiner turns to the next plate without comment.

(d) With the exception of the demonstration plate which is always first, the examiner must change the order of the plates frequently. The change should be made at least weekly and oftener if there is suspicion that the numbers have been learned in serial order by applicants.

(3) Scoring:

(a) If 10 or more responses to the 14 test plates are correct, the examinee will be considered as having normal color perception. The entry, Passes--VTS-CV, will be made in item 64, SF 88. If 5 or more incorrect responses are given, including failures to make responses, the examinee will be considered as having deficient color perception. The entry, Fails--VTS-CV, will be made in item 64 SF 88, with the number of incorrect responses.

(b) The demonstration plate is not considered in scoring. In plates with two-digit numbers incorrect responses to either is a failure for the plate.

c. Quantitative Test. The quantitative test is the Vision Test Apparatus, Color Threshold Tester, Stock No. 6516-388-3700. The color threshold tester uses eight colors presented in a specified order at eight different levels of intensity, a total of 64 test lights. The upper dial at the rear of the instrument controls the intensity of the test color. When in position 1, the intensity is at the lowest level; when in position 8, at the highest level. The lower dial controls the color of the test field.

(1) Procedure:

(a) The test is given in a dark room. The examinee is seated at a distance of 10 feet from the front surface of the instrument. He is told that the center light is the test light; the smaller lights on either side, guide lights to help him locate the test light. He is instructed to look midway between the two guide lights and is told that red, green, blue, white, yellow, and amber or orange lights will be shown. Before starting the actual test, a demonstration is given. The series of eight colors is shown at the highest intensity starting with color No. 8. Each is shown for about 5 seconds and is named by the operator. When the demonstration is completed, the person again is reminded to look midway between the two guide lights and to use only the names red, green, blue, white, yellow, and amber or orange. If he sees no light at all, he reports "Nothing." If he sees the test light but is not sure what name to give the color, he must guess.

(b) In the actual test the operator will present the 64 test lights as follows: He sets the intensity dial at No. 1 (lowest level) and shows the eight colors in order from No. 1 to No. 8. He then shifts the intensity disk to No. 2 and shows the eight colors in order from No. 8 to No. 1, then shifts the intensity disk to No. 3 and shows the colors from No. 1 to No. 8, etc. He writes the answers in a special blank, r for red, etc. The examinee is not allowed to change his answer after seeing the next test light.

(3) The answers counted correct for each of the eight colors are specified at the bottom of the record blanks. Thus, red is the only correct answer for the test colors No. 1 and No. 6. Color No. 2 may be called orange, yellow, or amber. Colors Nos. 3, 4, and 8 may be called either blue or green. Color No. 7 may be called white or yellow. A part score for each of the eight test colors is obtained by counting the correct responses, starting at the highest intensity level (No. 8) and counting to lower intensities until an error is made. Correct responses at still lower levels are not counted. Thus, if test color No. 1 is called red at levels 8 and 7 and amber at level 6, a score of 2 is entered for this test light. The method of obtaining the part scores is further illustrated under (2) below. The total score is the sum of the eight part scores.

★(2) AF Form 718, Color Vision Threshold Test Record. Air Force Form 718 is now being used to record all official quantitative test scores derived from the VTA-CTT. This form may be filled out by hand, but in all cases it should be filled out completely. Whenever the VTA-CTT is performed in conjunction with a physical examination, a copy of AF Form 718 should be attached to each of the SF 88, to be retained in the patient's AF Form 2150, The Treatment Record, and to each copy of the SF 88 forwarded to higher authority. If the quantitative test is performed separately from a physical examination, a copy of AF Form 718 will be filed in the patient's AF Form 2150. There is sufficient space on AF Form 718 to record the results of a second quantitative test. This space may be used to record the scores of an immediate repeat test when the results of the first test are critical to Grades 1, 2, or 3, or at any other appropriate time later in the patient's Air Force career. Once a satisfactory quantitative test is retained within the AF Form 2150, it need not be repeated in conjunction with any periodic physical examination, unless there is reason to suspect that the patient has developed an acquired deficiency of his, or her, color vision.

d. Interpretation of Results. Four degrees of color discrimination are distinguished by these tests. They are defined as follows:

(1) Normal Color Vision. Four or less errors in reading the 14 testing plates. (The quantitative test is not given if the screening test shows normal color vision.)

(2) Deficient Red-Green Color Perception, grade 1. Five or more errors on screening test; score 50 or better on quantitative test.

(3) Deficient Red-Green Color Perception, Grade 2. Five or more errors on screening test; score 49–35 on quantitative test.

(4) Deficient Red-Green Color Perception, grade 3 (complete red-green color deficiency). Five or more errors on screening test; score 34 or less on quantitative test.

e. Deficient Color Vision. When deficient color vision had been established in an individual, the screening test need not be repeated in subsequent examinations since congenital color blindness is unchanged throughout life. Acquired defects in color discrimination will be detected by tests of visual acuity or visual fields. The degree of deficiencies found when people are given the color vision test at regular intervals is likewise unchanged throughout life. Minor fluctuations in the score on the quantitative test do, however, occur because of chance factors. Therefore, when the score is within three points of the critical scores for grades 1, 2, and 3, the test should be repeated, and the classification of degree of defect based on the average (not the highest) score of two or more independent tests. Otherwise, repetition of the color vision test at regular intervals is unnecessary.

COLOR VISION THRESHOLD TEST RECORD

(THIS FORM IS AFFECTED BY THE PRIVACY ACT OF 1974)

LAST NAME - FIRST NAME - MIDDLE INITIAL (Print)	GRADE	SSAN	ORGANIZATION
	E-3	123-45-6789	213 TRANS SQ

TEST I	TOTAL SCORE	TEST GRADE	SIGNATURE OF TESTOR	DATE
	52	I		7 JAN 77

	COLOR DISC: RED A	ORANGE B	GREEN C	BLUE D	YELLOW E	RED F	WHITE G	GREEN H
INTENSITY DISC 1	-	R	B	-	R	R	R	W
2	Y	Y	W	W	Y	R	W	W
3	Y	Y	G	G	Y	R	Y	G
4	R	Y	G	G	Y	R	Y	G
5	R	Y	G	G	Y	R	W	G
6	R	O	G	G	Y	R	Y	G
7	R	O	G	B	O	R	W	G
8	R	O	G	B	O	R	W	G
PART SCORES	5	7	6	6	7	8	7	6
ANSWERS COUNTED CORRECT	RED	ORANGE YELLOW AMBER	GREEN BLUE	BLUE GREEN	YELLOW WHITE AMBER ORANGE	RED	WHITE YELLOW	GREEN BLUE

TEST II	TOTAL SCORE	TEST GRADE	AVERAGE GRADE I AND II	SIGNATURE OF TESTOR	DATE

	COLOR DISC: RED A	ORANGE B	GREEN C	BLUE D	YELLOW E	RED F	WHITE G	GREEN H
INTENSITY DISC 1								
2								
3								
4								
5								
6								
7								
8								
PART SCORES								

REMARKS

Patient within 3 points of critical score separating grades I and II deficiencies. Will Retest tomorrow. (Missed 6 plates on VTS-CV.)

Figure 3

AF FORM JAN 76 718

Exercise 4- 1h

Answer the following questions in the spaces provided.

1. If an examinee fails the VTS-CV, it is possible to verify his color vision deficiency by using the ______________________________ or the ______________________________.

2. In order to pass the color threshold test a score of ____________________ or better is necessary for flying training examinees.

3. How many incorrect responses are permitted to pass the VTS-CV? ____________________

How many incorrect responses then must the examinee give you to fail the test? ____________________

4. An examinee misses 8 of 15 plates on the VTS-CV. Make the appropriate entry which should be made on Item 64, SF 88, ______________________________

____

5. In question 4, if you then conducted a color threshold test on the examinee and he scored 48, make the appropriate entry for this test and the result.

____

Under what item of SF 88 would this entry be made? ____________________

____

6. Can the color plate test be administered with only normal room lights on? ____________________

____________________ Explain.

Evaluate the following USAF-CTT score sheet. Correctly score and indicate test grade IAW AFR 160-43. On reverse side enter disposition of patient. Consider patient to be applicant for pilot training. Passing score is 100 percent. Use of task sheet OK.

SCORE SHEET

NAME AND SERIAL NO ______________________________ DATE ____________________

SCORE ____________ TEST GRADE ____________________

COLOR DISC

	1 red	2 orange	3 green	4 blue	5 yellow	6 red	7 white	8 green
1	W	O	G	B	Y	R	W	G
2	W	W	G	B	Y	W	W	G
3	O	O	G	B	Y	O	A	G
4	R	Y	B	G	W	O	W	B
5	O	A	B	G	A	R	W	B
6	R	A	G	G	O	R	Y	B
7	R	Y	G	B	O	R	W	G
8	O	Y	G	B	O	R	W	G
Part Scores								
Answers Counted Correct	red	orange yellow amber	green blue	blue green	yellow white amber orange	red	white yellow	green blue

OBJECTIVE

Given 10 selected visual acuity results and SW J3ABR91235 000-IV, classify the "E" portion of the physical profile, with 70% accuracy.

Purpose

The physical profile serial is an important device for communicating the general physical condition of an examinee to nonmedical administrative personnel, e.q., AF recruiting officer, CBPO, Military Personnel Center, and other concerned offices. The physical profile series can be used in the determination of an examinee's eligibility for enlistment or retention in the Air Force, for assignments and for possible selection or retention in specific career fields. This information is listed in AFR 39-1 and AFM 36-1.

Every airman enlisting for active duty in the Air Force must meet certain minimum medical qualifications to be eligible. Once on active duty, if the individual seeks training in a specific career field, there may be other minimum medical qualifications he/she must meet which are over and above those he/she had to meet for enlistment. Individuals cannot be assigned to, nor trained into, an AFSC for which they do not meet the minimum physical requirements. Periodically everyone on active duty must take a physical examination which determines if they are physically eligible to remain on active duty (i.e., qualified for worldwide duty) or within a certain career field. Any change in profile may require a job (AFSC) reclassification and retraining and/or temporary assignment limitation. Medical defects which are disqualifying for worldwide duty must be presented to a medical board. After any of these physical examinations, the resultant physical profile series can be used by nonmedical administrative personnel as a quick reference to determine the general physical condition of an examinee.

Chapter 3 of AFR 160-43 describes the physical profile serial. Portions of this chapter have been extracted from the regulation and follow below. Note in particular the meaning of PULHESX with the emphasis on the "E". You will be required to be very familiar with the E column (Vision ; eyes) in Attachment 6. Many examples will be given to you in class by your instructor.

Note how the PULHESX is recorded in Item 76 of the SF 88 (Figure 4). Also note how the PULHESX is recorded on AF Form 422, Physical Profile Serial Report, (Figure 5). This form is usually used to revise a physical profile serial. Three copies of the form are usually prepared but local procedures at each different base may dictate local uses and procedures and amount of copies. Notice in Section II that there is a space for previous PULHESX and revised PULHESX. In Section III, defective color vision may be addressed as well as whether all the above restrictions are temporary or permanent. This form is usually not filled out by Optometry Clinic personnel but you may be required to have some input of information. AFR 160-43 will be extremely helpful.

Chapter 3

ADMINISTRATIVE CONSIDERATIONS

3-1. Physical Profile Serial:

a. Purpose. The physical profile serial is a device for communicating the general physical condition of an examinee to nonmedical personnel. The profile system exists to facilitate certain personnel, training, or command actions. The AF Form 422, Physical Profile Serial Report, is the usual vehicle by which the physician or Medical Evaluation Board transmits the physical profile serial and related information. The profile may effectively advise the CBPO of the fact that an individual is qualified for worldwide duty or that the individual has a medical defect which requires temporary or permanent occupational restriction. A change in profile may entail job (AFSC) reclassification or retraining or temporary assignment limitation. See AFM 168-4, paragraphs 16-11 and 16-12 for further discussion of medical defects and their categorization. Certain career fields have minimum medical qualification and profile requirements which are over and above the basic "worldwide duty" criteria of chapter 5. These minimums are found in AFM 39-1 (enlisted) and AFM 36-1 (officer). An individual should not be assigned to nor trained into an AFSC for which he or she does not meet minimum requirements. If the unit commander has a question as to an individual's medical suitability for an AFSC he should consult the medical member of the Base Classification Board (AFR 35-1), the Physical Profiling Officer, or Director of Base Medical Services.

b. Criteria. The criteria of chapter 5 and attachment 2 are used to establish or adjust the physical profile during the active duty period. Profiling guidance applicable to Army members will be found in AR 40-501. The Navy and Marine Corps do not utilize a profile system.

c. Factors. For profiling purposes, human functions are divided into seven factors which are designated "P", "U", "L", "H", "E", "S", and "X."

(1) "P" General Physical Status relative to Organic Defects or Systemic Diseases. Systemic diseases and organic defects that would not normally be shown in the other profile factors are recorded under "P". Examples are the present status of degenerative, gastrointestinal, cardiovascular, renal and pulmonary diseases, allergies, hernias and endocrine disorders, dental and congenital defects, etc. If an examinee's profile is downgraded under some other factor, the grade of the "P" factor depends on the degree to which the responsible defect influences the "P" factor.

(2) "U" Upper Extremities. Functional use of hands, arms, shoulder girdle and spine (cervical and thoracic) to include strength, range of motion, and general efficiency.

(3) "L" Lower Extremities. Funtional use, strength, range of motion, and general efficiency of feet, legs, pelvic girdle, lower back, and lumbar and sacral spine.

(4) "H" Hearing. Only auditory acuity is considered. See attachment 3 for instructions for establishing "H" profiles. Organic defects of the ears are profiled under "P."

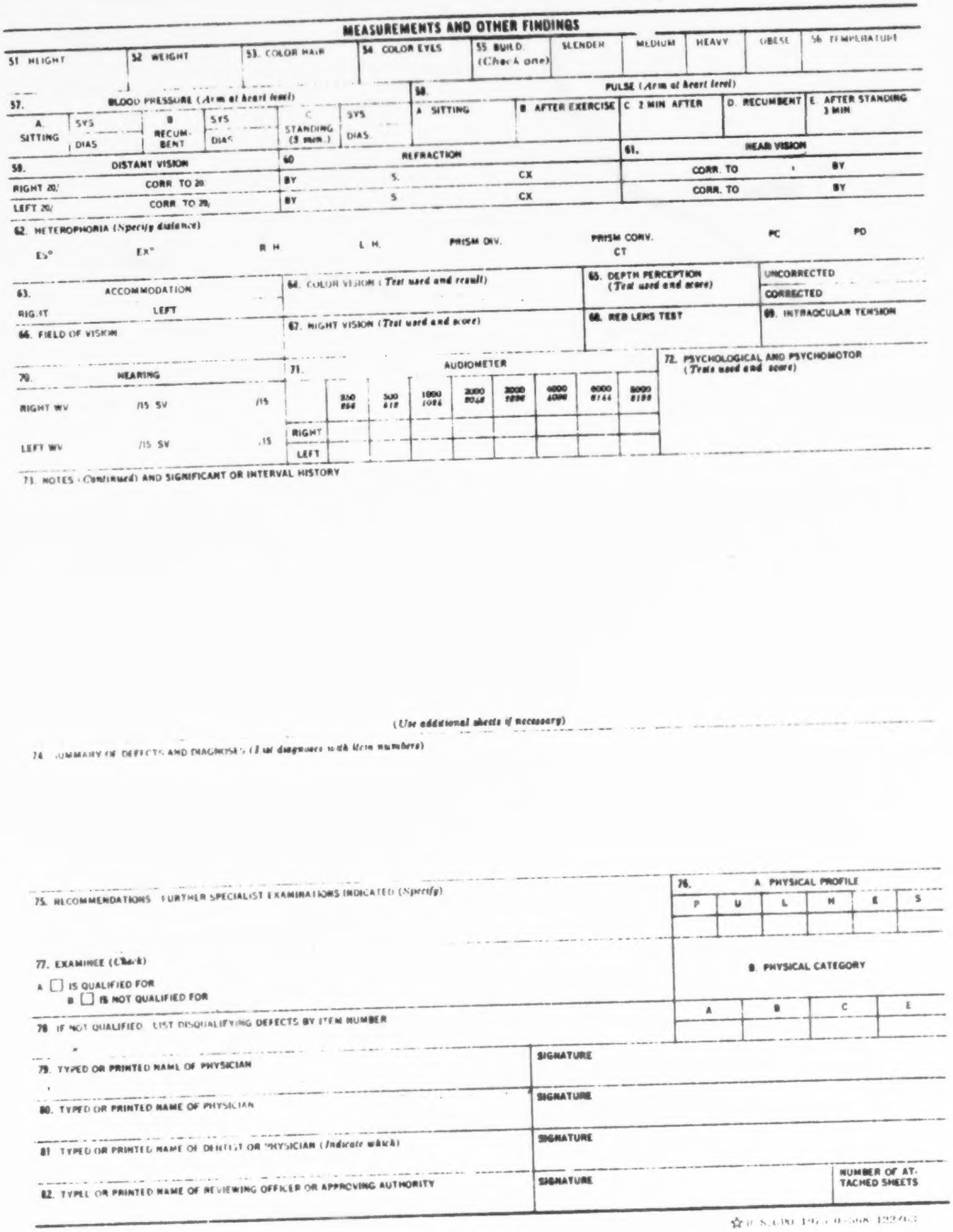
(5) "E" Eyes. Only distant visual acuity is considered. See attachment 2 for instructions for establishing "E" profiles. Organic eye diseases and visual field impairments are profiled under "P". Near visual acuity and color vision are not considered in establishing the "E" profile.

(6) "S" Psychiatric. Emotional stability and neuropsychiatric history and findings are considered. Character and behavior disorders may be medically disqualifying for initial entry; however, once the individual assumes active duty status, and in the absence of coexisting psychotic or psychoneurotic conditions, disregard character and behavior disorders in establishing or adjusting the psychiatric "S" profile. Disposition of active duty members with character-behavior disorders who fail to perform effectively is administrative rather than medical.

(7) "X" Physical Work Capacity. Overall strength, stamina, and muscular coordination, as they relate to a person's ability to work a prolonged workday or week under varying environments and a variety of occupational requirements, are considered. The Physical Work Capacity factor is also influenced by other characteristics such as agility, biological age, body structure, obesity, height or weight, and personal living habits. The "X" factor may be influenced by other profile factors, but will not necessarily numerically correspond with them. The "X" factor will be judgementally determined following the physical examination when no means for local objective evaluation, as described in attachment 2, is available. As with other profile factors, factor "X" is determined without regard to, or special consideration for, the sex of the applicant or member.

PHYSICAL PROFILE SERIAL CHART

Profile serial	P Physical Condition	U Upper extremities	L Lower extremities	H Hearing: ears	E Vision: eyes	S Neuropsychiatric	X Physical Work Capacity
1	Free of any significant organic defect or systemic disease	Bones, joints, and muscles normal. Must be able to do hand to hand fighting.	Bones, muscles, and joints normal. Must be capable of performing long marches and continuous standing over periods. No defects which disqualify for running, climbing, and digging.	See paragraph 5-6 and attachment 7	Minimum vision of 20/70 in each eye correctable to 20/20 in one eye and 20/30 in the other	No psychiatric disorder.	Able to perform maximum heavy duty over prolonged periods (as demonstrated by a lift of 70 pounds to a height of 6 feet)
2	Presence of minimally significant organic defect(s) or systemic disease(s)	Slightly limited mobility of joints, muscular weakness, or other musculo-skeletal defects which do not prevent hand-to-hand fighting and do not disqualify for prolonged effort	Slightly limited mobility of joints, muscular weakness, or other musculo-skeletal defects which do not prevent moderate marching, climbing, running, digging or prolonged effort.	See paragraph 5-6 and attachment 7.	Vision correctable to 20/40 in one eye and 20/70 in the other, or 20/30 in one eye and 20/100 in the other, or 20/20 in one eye and 20/400 in the other.	Individual has mild transient psychoneurotic reaction.	Able to perform sustained moderate duty over prolonged periods (as demonstrated) by a lift of 40 pounds to elbow height)
3	Significant defect(s) and/or disease(s) under good control, and not requiring regular and close medical support. Capable of all basic work commensurate with rank and position.	Defects causing moderate interference with function, yet capable of sustained effort for short periods	Defects causing moderate interferrence with function, but capable of sustained effort for short periods.	See parapgraph 5-6 and attachment 7.	Vision correctable to 20/40 in the better eye.	Individual has a mild chronic psychoneurosis, moderate transient psychoneurotic reaction, or history of transient psychotic reaction.	Able to perform standard light duty over normal work periods (as demonstrated by a lift of 20 pounds to elbow height).
4	Medically unacceptable for worldwide service or qualification questionable, including remote and isolated duty (chapter 5 of this regulation). Use 4 profile only with "T" or "L" suffix for members on extended active duty and AFRES/ANG personnel eligible under AFM 35-4, chapter 8						
	Organic defects(s) systemic and infectious disease(s) with examples of diabetes mellitius, hypertension, arthritis, dental masticatory malfunction, endocrinopathies neoplasms, etc	Strength, range of motion, and general efficiency of upper arm, shoulder girdle, and back, including cervical, thoracic.	Strength, range of movement, and efficiency of feet, legs pelvic girdle, lower back, and lumbar vertebrae.	Auditory acuity unless there is a defect listed as unacceptble in attachment 7	Distant visual acuity unless there is a defect listed as unacceptable in paragraph 4-7.	Type, severity, and duration of the psychiatric symptoms of disorder existing at the time the profile is determined. Amount of external precipitating stress. Predisposition as determined by the basic personality makeup, intelligence performance, and history of past psychiatric disorders. Impairment of functional capacity	Strength, stamina muscular coordination, agility, body structure, wieght, height, vigor/energy, biological age, obesity, personal living habits, etc.



MEASUREMENTS AND OTHER FINDINGS

51. HEIGHT	52. WEIGHT	53. COLOR HAIR	54. COLOR EYES	55. BUILD (*Check one*)	SLENDER	MEDIUM	HEAVY	OBESE	56. TEMPERATURE

57. BLOOD PRESSURE (*Arm at heart level*)								58. PULSE (*Arm at heart level*)				
A. SITTING	SYS	B. RECUMBENT	SYS	C. STANDING (3 min.)	SYS			A. SITTING	B. AFTER EXERCISE	C. 2 MIN AFTER	D. RECUMBENT	E. AFTER STANDING 3 MIN
	DIAS		DIAS		DIAS							

59. DISTANT VISION		60. REFRACTION			61. NEAR VISION		
					CORR. TO		BY
RIGHT 20/	CORR. TO 20/	BY	S.	CX	CORR. TO		BY
LEFT 20/	CORR. TO 20/	BY	S.	CX			

62. HETEROPHORIA (*Specify distance*)

ES°	EX°	R. H.	L. H.	PRISM DIV.	PRISM CONV.	PC	PD
					CT		

63. ACCOMMODATION	64. COLOR VISION (*Test used and result*)	65. DEPTH PERCEPTION (*Test used and score*)	UNCORRECTED
RIGHT / LEFT			CORRECTED
66. FIELD OF VISION	67. NIGHT VISION (*Test used and score*)	68. RED LENS TEST	69. INTRAOCULAR TENSION

70. HEARING	71. AUDIOMETER									72. PSYCHOLOGICAL AND PSYCHOMOTOR (*Tests used and score*)
RIGHT WV /15 SV /15		250 256	500 512	1000 1024	2000 2048	3000 2896	4000 4096	6000 6144	8000 8192	
	RIGHT									
LEFT WV /15 SV /15	LEFT									

73. NOTES (*Continued*) AND SIGNIFICANT OR INTERVAL HISTORY

(*Use additional sheets if necessary*)

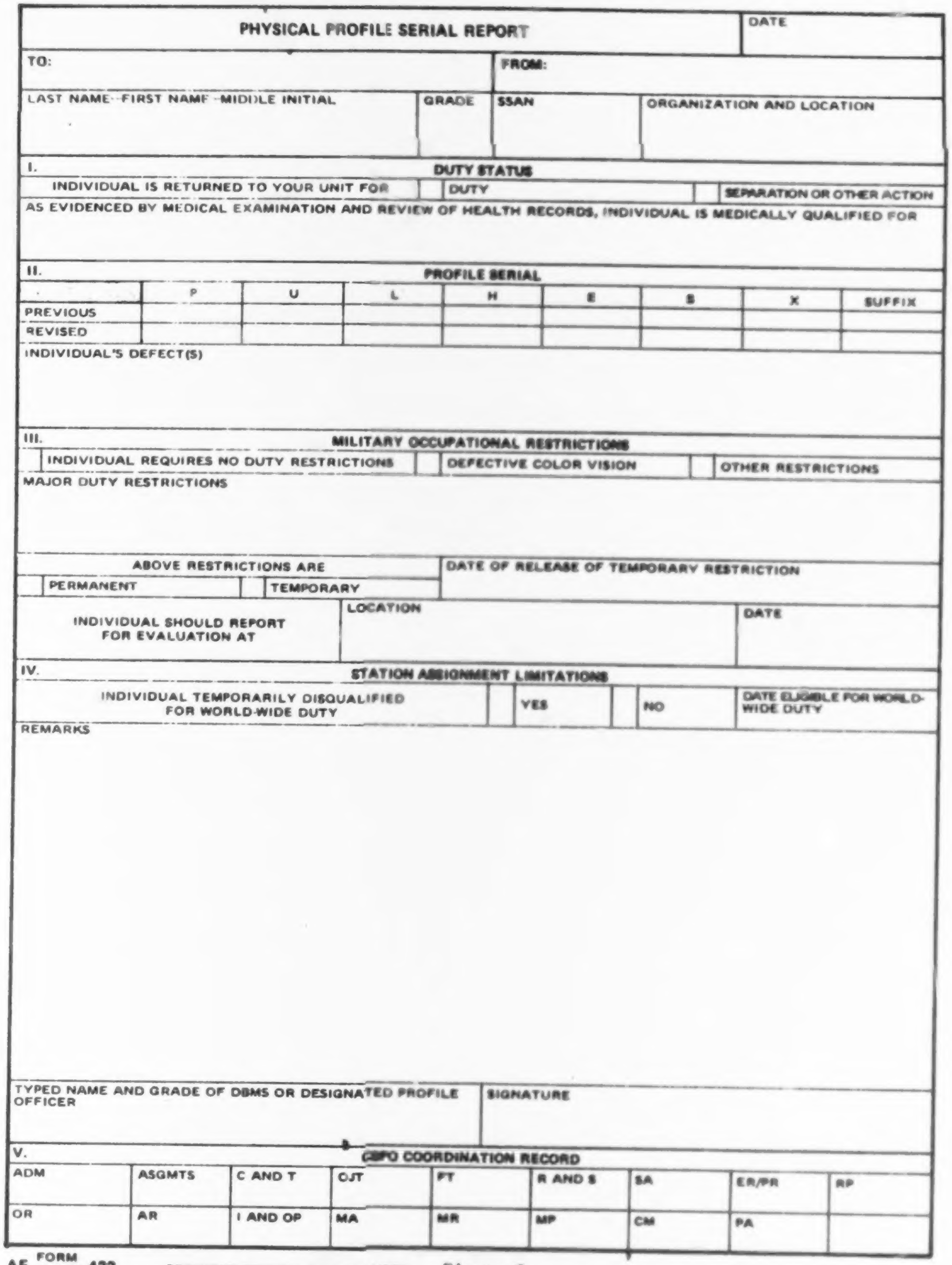
74. SUMMARY OF DEFECTS AND DIAGNOSES (*List diagnoses with item numbers*)

75. RECOMMENDATIONS—FURTHER SPECIALIST EXAMINATIONS INDICATED (*Specify*)	76. A. PHYSICAL PROFILE					
	P	U	L	H	E	S
77. EXAMINEE (*Check*) A. ☐ IS QUALIFIED FOR B. ☐ IS NOT QUALIFIED FOR	B. PHYSICAL CATEGORY					
	A	B	C	E		
78. IF NOT QUALIFIED, LIST DISQUALIFYING DEFECTS BY ITEM NUMBER						

79. TYPED OR PRINTED NAME OF PHYSICIAN	SIGNATURE	
80. TYPED OR PRINTED NAME OF PHYSICIAN	SIGNATURE	
81. TYPED OR PRINTED NAME OF DENTIST OR PHYSICIAN (*Indicate which*)	SIGNATURE	
82. TYPED OR PRINTED NAME OF REVIEWING OFFICER OR APPROVING AUTHORITY	SIGNATURE	NUMBER OF ATTACHED SHEETS

☆ U.S. GPO: 197[illegible] 0-568-122/63

Figure 4



PHYSICAL PROFILE SERIAL REPORT	DATE

TO:		FROM:	
LAST NAME--FIRST NAME--MIDDLE INITIAL	GRADE	SSAN	ORGANIZATION AND LOCATION

I. DUTY STATUS

INDIVIDUAL IS RETURNED TO YOUR UNIT FOR ☐ DUTY ☐ SEPARATION OR OTHER ACTION

AS EVIDENCED BY MEDICAL EXAMINATION AND REVIEW OF HEALTH RECORDS, INDIVIDUAL IS MEDICALLY QUALIFIED FOR

II. PROFILE SERIAL

	P	U	L	H	E	S	X	SUFFIX
PREVIOUS								
REVISED								

INDIVIDUAL'S DEFECT(S)

III. MILITARY OCCUPATIONAL RESTRICTIONS

☐ INDIVIDUAL REQUIRES NO DUTY RESTRICTIONS ☐ DEFECTIVE COLOR VISION ☐ OTHER RESTRICTIONS

MAJOR DUTY RESTRICTIONS

ABOVE RESTRICTIONS ARE ☐ PERMANENT ☐ TEMPORARY	DATE OF RELEASE OF TEMPORARY RESTRICTION

INDIVIDUAL SHOULD REPORT FOR EVALUATION AT	LOCATION	DATE

IV. STATION ASSIGNMENT LIMITATIONS

INDIVIDUAL TEMPORARILY DISQUALIFIED FOR WORLD-WIDE DUTY	☐ YES	☐ NO	DATE ELIGIBLE FOR WORLD-WIDE DUTY

REMARKS

TYPED NAME AND GRADE OF DBMS OR DESIGNATED PROFILE OFFICER	SIGNATURE

V. CBPO COORDINATION RECORD

ADM	ASGMTS	C AND T	OJT	PT	R AND S	SA	ER/PR	RP
OR	AR	I AND OP	MA	MR	MP	CM	PA	

AF FORM JAN 76 422 PREVIOUS EDITION WILL BE USED.

Figure 5

MEDICAL/VISUAL STANDARDS

The USAF has medical/visual standards for various types of physical examinations that are derived from the physical abilities required for proper performance of duty. AFR 160-43, Chapter 14 lists the requirements for various jobs in the Air Force. The Chart on Page 54 lists the visual requirementsfor the main types of physical examinations. There is also in Figure 5, the eye section of the SF 88 showing which blocks are completed for the main types of physical exams.

The Different Types of Physical Exams.

Flying Class I - Qualifies for pilot training.

Flying Class IA - Qualifies for navigator training those applicants who cannot meet Class I visual requirements.

Flying Class II - Qualifies those personnel who hold the current rating of pilot or navigator. These are already trained pilots and navigators who take an annual physical exam to remain qualified.

Flying Class III - Qualifies those personnel who are not involved in primary control of aircraft. This includes flight surgeons, flight nurses and enlisted personnel (engineers, boom operators, loadmasters, air traffic controllers, etc.).

Commission - Qualifies officers for non flying duties.

Enlistment - qualifies non-officers and non-flying enlisted personnel for worldwide Air Force duty.

An excerpt of AFR 160-43 Chapter 4 follows.

Chapter 4

MEDICAL STANDARDS FOR ENLISTMENT, COMMISSION, AND FLYING

4-1. General:

a. The medical conditions listed in this chapter are causes for rejection of the examinee for enlistment, appointment, flying training or flying duty, as indicated. These medical standards also apply to voluntary EAD of Reserve Forces personnel, Air National Guard and EAD of AFROTC graduates delayed under AFR 45-31. Some of the qualifying terms in delineating causes for rejection, such as "mild," "moderate," and "severe" or "small," "medium," and "large" cannot be stated in more precise language, and rely heavily on the judgment and description of the examining physician. For that reason, this list of medical standards should be considered as a guide to the examining physician, as well as to reviewing authorities.

b. These medical standards do not apply to nonprior-service enlistees or to special registrants (see note following paragraph 1-1b(2)).

4-7. Eye. Causes for Rejection:

a. Enlistment and Commission.

(1) Lids:

(a) Ingrowing eyelashes.

(b) Destruction of the lids sufficient to impair protection of the eye from exposure.

(c) Disfiguring scars and adhesions of the lids to each other or to the eyeball.

(d) Blepharitis, chronic, unless mild and considered by the examiner unlikely to interfere with performance of military duty.

(e) Blepharospasm.

(f) Ptosis that interferes with vision.

(g) Inversion or eversion of the eyelids.

(h) Lagophthalmos.

(i) Growths or tumors of the eyelid, except small, asymptomatic and nonprogressive benign lesions.

(j) Dacyrocystitis, acute or chronic.

(k) Epiphora.

(2) Conjunctiva:

(a) Conjunctivitis, acute, until recovered.

(b) Conjunctivitis, chronic, including vernal catarrh.

(c) Trachoma, unless healed without scarring

(d) Xerophthalmia.

(e) Pterygium that encroaches on the cornea more than 1 mm., interferes with vision, or is progressive (as evidenced by marked vascularity or a thick elevated head).

(3) Cornea:

(a) Keratitis, acute or chronic.

(b) Corneal ulcer. History of recurrent corneal ulcers or corneal abrasions (including herpetic ulcers).

(c) Vascularization or opacification of the cornea from any cause when it is progressive or interferes with vision.

(d) Corneal dystrophy of any type, including keratoconus of any degree.

(4) Uveal Tract. Inflammation of the uveal tract (iris, ciliary body or choroid), acute, chronic, or recurrent.

(5) Retina:

(a) History of detachment of the retina.

(b) Degenerations of the retina, to include macular cysts, holes and other degenerations (hereditary or acquired) and other conditions affecting the macula. All types of pigmentary degenerations (primary and secondary).

(c) Retinitis or other inflammatory conditions of the retina.

(d) Chorioretinitis, unless healed and not interfering with vision.

(6) Optic Nerve:

(a) Optic neuritis, neuroretinitis or a documented history of retrobulbar neuritis.

(b) Optic atrophy (primary or secondary).

(c) Papilledema.

(7) Lens:

(a) Aphakia, unilateral or bilateral.

(b) Dislocation of a lens, partial or complete.

(c) Opacities of the lens that interfere with vision or are considered to be progressive.

(8) Other defects and disorders:

(a) Asthenopia, if severe.

(b) Tumor of the eye or orbit.

(c) Exophthalmos, unilateral or bilateral.

(d) Nystagmus.

(e) Diplopia.

(f) Hemianopsia.

(g) Loss of normal pupillary reflexes.

(h) Retained intraocular foreign body.

(i) Absence of an eye.

(j) Anophthalmos or microphthalmus.

(k) Any organic or congenital disorder of the eye or adnexa, not specified above, which threatens to impair visual function.

b. Flying Classes I, IA, II, and III. Same as "a" In addition:

(1) History of chorioretinitis.

(2) History of uveitis.

(3) History of optic neuritis.

(4) History of iritis.

(5) History of choroiditis.

(6) History of retinitis.

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4-8. Refraction. Causes for Rejection:

a. Enlistment and Commission:

(1) Refractive error in spherical equivalent of more than +8.00 or −8.00 diopters; or if ordinary spectacles cause discomfort because of ghost images, prismatic displacement, etc.

(2) Complex refractive errors that can be corrected only by contact lenses.

b. Flying Classes II and III:

(1) Refractive error of more than +5.50 or −5.50 diopters in any meridian.

(2) Astigmatism requiring more than 3.00 diopters of cylinder.

(3) Anisometropia greater than 3.50 diopters.

(4) Complex refractive errors that can be corrected only by contact lenses.

(5) Optional or required use of contract lenses.

c. Flying Class 1A:

(1) Refractive error of more than +3.00 or −1.50 diopters in any meridian.

(2) If 21 years or older, a refractive error of more than +3.00 or −2.75 diopters in any meridian.

(3) Astigmatism requiring more than 2.00 diopters of cylinder.

(4) Optional or required use of contact lenses.

d. Flying Class I:

(1) Refractive error of more than +1.75 or −0.25 diopters in any meridian.

(2) Astigmatism requiring more than 0.75 diopters of cylinder.

(3) Optional or required use of contact lenses.

4-9. Distant Vision. Causes for Rejection:

a. Enlistment and Commission. Corrected distant visual acuity which exceeds a physical profile serial of "E-2." Provided the defective vision is not due to active or progressive conditions. Instructions regarding physical profile serial are shown in attachment 2.

b. Flying Class III:

(1) Uncorrected vision, less than 20/400 each eye.

(2) Corrected vision, less than 20/20 in one eye and 20/30 in the other eye.

c. Flying Class II:

(1) Uncorrected vision, less than 20/200 each eye.

(2) Corrected vision, less than 20/20 each eye.

d. Flying Class IA:

(1) Uncorrected vision, less than 20/70 each eye except

(2) If 21 years or older, uncorrected vision less than 20/200 each eye.

(3) Corrected vision, less than 20/20 each eye.

e. Flying Class I. Uncorrected vision, less than 20/20 each eye.

4-10. Near Vision. Causes for Rejection:

a. Enlistment.

(1) Uncorrected vision of any degree is not a cause for rejection.

(2) Corrected vision less than 20/40 (J-6) in the better eye.

b. Commission:

(1) Uncorrected vision. No standard.

(2) Corrected vision less than 20/20 (J-1) in one eye and 20/30 (J-4) in the other.

c. Flying Class II:

(1) Uncorrected vision less than 20/200 each eye.

(2) Corrected vision less than 20/20 each eye.

d. Flying Class I:

(1) Uncorrected vision less than 20/20 each eye.

e. Flying Class IA:

(1) Uncorrected vision less than 20/20 each eye except

(2) If 21 years or older, uncorrected vision less than 20/40 each eye and corrected vision less than 20/20 each eye.

4-11. Field of Vision. Causes for Rejection:

a. Enlistment and Commission.

(1) Changes in the visual fields that significantly interfere with binocular visual function.

b. Flying Classes II and III.

(1) Contraction of the normal visual field in either eye of 15° or more in any meridian.

(2) Scotoma that is due to active pathological process.

(3) Any scotoma that is the result of a healed lesion, unless it is the opinion of the examiner that it will not compromise the flying efficiency or well-being of the examinee.

c. Flying Classes I and IA.

(1) Contraction of the normal visual field in either eye of 15° or more in any meridian.

(2) Any demonstrable scotoma other than physiologic.

4-12. Color Vision. Causes for Rejection:

a. Enlistment and Commission. No standard. However, color vision will be determined using VTS-CV and recorded on the S 88 since normal color vision is a prerequisite for entry into a number Air Force occupational specialties.

NOTE: Normal color vision is defined as a score of 10 or better on the VTS-CV, FSN 6515-299-8186.

b. Flying Classes I, IA, II, and III. Five or more incorrect responses, including failures to make responses, in reading the 14 test charts of the standard color vision test set (VTS-CV), unless the examinee makes a score of 50 or better on the color threshold tester (VTA-CTT).

NOTE: The Farnsworth Lantern Test (FALANT) when administered in accordance with the instruction attached to the instrument is an acceptable test for resolution of cases of questionable color perception at those medical facilities where the VTA-CTT is not available.

4–13. Night Vision. Causes for Rejection:

a. Enlistment and Commission:

(1) Verified congenital night blindness.

(2) Night blindness associated with objective diseases of the eye.

b. Flying Classes I, IA, II and III. Unsatisfactory night vision as determined by history and confirmed by the test described in paragraph 2–2e(17).

4–14. Depth Perception. Causes for Rejection:

a. Enlistment, Commission, and Flying Class III. No standard.

b. Flying Classes I, IA and II:

(1) An error in groups B, C or D, when using the VTA-ND.

(2) When using the Verhoeff depth perception apparatus (DPA-V), any error in eight presentations during the first trial, or any error during a second or third trial, if required.

(3) Average error greater than 30 mm., using the Howard-Dolman apparatus (DPA-HD).

4–15. Heterophoria and Heterotropia. Causes for Rejection:

a. Enlistment and Commission. Heterotropia of more than 15 degrees (26 prism diopters).

b. Flying Class III:

(1) Esophoria greater than 15 prism diopters.

(2) Exophoria greater than 8 prism diopters.

(3) Hyperphoria greater than 2 prism diopters.

(4) Heterotropia.

c. Flying, Classes I, IA and II.

(1) Esophoria greater than 10 prism diopters.

(2) Exophoria greater than 5 prism diopters.

(3) Hyperphoria greater than 1.5 prism diopters.

(4) Heterotropia.

(5) Point of convergence (PC) greater than 70 mm.

(6) History of extraocular muscle surgery is cause for complete evaluation of ocular motility by an ophthalmologist.

4–16. Red Lens Test. Causes for Rejection:

a. Enlistment, Commission, and Flying Classes II and III. No standards.

b. Flying Classes I and IA. Any diplopia or suppression during the red lens test which develops within 20 inches of the center of the screen is considered a failure. Failure of this test in the absence of other eye defects or disorders is not necessarily disqualifying for flying training. However, failure of this test should be cause for a complete evaluation of ocular mobility and motility by a qualified ophthalmologist with an opinion as to the reason for the failure.

4–17. Near Point Accommodation. Causes for Rejection:

a. Enlistment, Commission and Flying Classes II and III. No standard.

b. Flying Classes I and IA. Near point of accommodation less than the minimum for age, shown in attachment 7, table A.

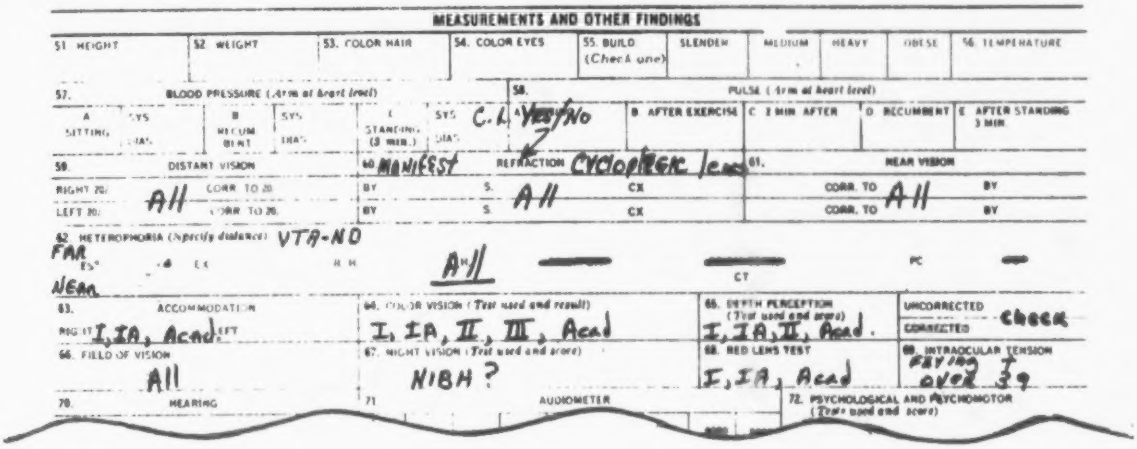
4–18. Intraocular Tension. Causes for Rejection:

a. Enlistment, Commission and Flying Classes II and III.

(1) Glaucoma, as evidenced by tension above 30 mm. Hg., or the secondary changes in the optic disc or visual field associated with glaucoma. (See attachment 11, paragraph 19.)

(2) Two or more determinations of 22 mm. Hg., or higher, or a difference of more than 4 mm Hg. between the tension in the two eyes may represent "preglaucoma" and warrants a thorough evaluation by a qualified ophthalmologist.

b. Flying Classes I and IA. Glaucoma or preglaucoma.



MEASUREMENTS AND OTHER FINDINGS

51. HEIGHT	52. WEIGHT	53. COLOR HAIR	54. COLOR EYES	55. BUILD (Check one)	SLENDER	MEDIUM	HEAVY	OBESE	56. TEMPERATURE

57. BLOOD PRESSURE (Arm at heart level)
A SITTING SYS DIAS
B RECUMBENT SYS DIAS
C STANDING (3 min.) SYS DIAS C.L.

58. PULSE (Arm at heart level)
A Yes/No
B AFTER EXERCISE
C 2 MIN. AFTER
D RECUMBENT
E AFTER STANDING 3 MIN.

59. DISTANT VISION
RIGHT 20/ All CORR. TO 20/
LEFT 20/ CORR. TO 20/

60. MANIFEST REFRACTION Cycloplegic lens
BY S. All CX
BY S. CX

61. NEAR VISION
CORR. TO All BY
CORR. TO BY

62. HETEROPHORIA (Specify distance) VTA-NO
FAR
ES° EX R.H. All — — CT PC —
NEAR

63. ACCOMMODATION
RIGHT I, IA, Acad. LEFT

64. COLOR VISION (Test used and result)
I, IA, II, III, Acad

65. DEPTH PERCEPTION (Test used and score)
I, IA, II, Acad.
UNCORRECTED
CORRECTED Check

66. FIELD OF VISION
All

67. NIGHT VISION (Test used and score)
NIBH ?

68. RED LENS TEST
I, IA, Acad

69. INTRAOCULAR TENSION
Flying T over 39

70. HEARING

71. AUDIOMETER

72. PSYCHOLOGICAL AND PSYCHOMOTOR (Tests used and score)

Figure 6

INSTRUCTIONS AND STANDARDS FOR COMPLETION OF SF 88 EYE EXAM (AFR 160-43)

TYPE OF EXAM	59.DISTANCE VA	61. NEAR VA	60. REFR. ERROR	62.PHORIA/TROPIA	63. ACCOM.	64. COLOR	65. DEPTH	66. FIELDS	67.NIGHT VISION	68. RED LENS
Class I Pilot Tng. (Cycloplegic)	$\overline{\text{SC}}$ 20/20 20/20 (100% of line)	$\overline{\text{SC}}$ 20/20 20/20	Total in any meridian: +1.75 -0.25 Astig: 0.75	Eso 10$^{\Delta}$ Exo 5$^{\Delta}$ Hyper 1.5$^{\Delta}$ Heterotropia Required PC: 70 (Refer if Hx of EOM surgery)	AGE DIOPTERS 17 ... 8.8 18 ... 8.6 19 ... 8.4 20 ... 8.1 21 ... 7.9 22 ... 7.7 23 ... 7.5 24 ... 7.2 25 ... 6.9 26 ... 6.7 27 ... 6.5 28 ... 6.2 29 ... 6.0 30 ... 5.7 31 ... 5.4 32 ... 5.1 33 ... 4.9 34 ... 4.6 35 ... 4.3 36 ... 4.0 37 ... 3.7 38 ... 3.4 39 ... 3.1 40 ... 2.8 41 ... 2.4	VTS-CV Pass 10 of 14 plates or VTA-CTT 50 or FALANT Pass	VTA-ND Pass (D, E or F) or DPA-V Pass or H-D 30 or less	15° Loss in any meridian or any nonphysiologic scotoma is disqualifying	Not required unless indicated by history	No diplopia or suppression within 20" of center of screen. (Refer to Ophth. if failed)
Class IA Nav. Tng. (Under 21) (Cycloplegic)	$\overline{\text{SC}}$ 20/70 20/70 $\overline{\text{CC}}$ 20/20 20/20 (100% of line)	$\overline{\text{SC}}$ 20/20 20/20	+3.00 -1.50 Astig: 2.00	SAME		SAME	SAME	SAME	SAME	SAME
Class IA Nav. Tng. (21 or older) (Cycloplegic)	$\overline{\text{SC}}$ 20/200 20/200 $\overline{\text{CC}}$ 20/20 20/20 (100% of line)	$\overline{\text{SC}}$ 20/40 20/40 $\overline{\text{CC}}$ 20/20 20/20	+3.00 -2.75 Astig: 2.00	SAME		SAME	SAME	SAME	SAME	SAME
Class II Flying, Periodic (Manifest)	$\overline{\text{SC}}$ 20/200 20/200 $\overline{\text{CC}}$ 20/20 20/20 (75% of line)	$\overline{\text{SC}}$ 20/200 20/200 $\overline{\text{CC}}$ 20/20 20/20	+5.50 -5.50 Astig: 3.00 Aniso: 3.50 (Compare meridia of max error OU)	SAME	X	SAME	SAME	SAME	SAME	X
Class III Flying (Not in primary control of acft.) (Manifest)	$\overline{\text{SC}}$ 20/400 20/400 $\overline{\text{CC}}$ 20/20 20/30 (75% of line)	$\overline{\text{SC}}$ No Standard $\overline{\text{CC}}$ 20/20 20/30	SAME	Eso 15$^{\Delta}$ Exo 8$^{\Delta}$ Hyper 2$^{\Delta}$ Heterotropia	X	SAME	X	SAME	SAME	X
Commission (Nonflying) (Manifest)	Physical profile of E-2 or better. No active pathology $\overline{\text{SC}}$ No Standard	SAME	SAME	Heterotropia over 15° (26$^{\Delta}$) disqualifying. (Measured on initial P.E. only)	X	Perform test and record results	X	No defects which significantly interfere with binoc. vision	Nyctalopia Disqualifies	X
A.F. Academy & AFROTC (See AFR 160-13)	$\overline{\text{SC}}$ No Standard $\overline{\text{CC}}$ 20/20 20/20	- (MUST MEET ALL STANDARDS OF CATEGORY OF ACCEPTANCE OR APPLICATION) - - - - - - - - - -								
Enlistment (Manifest)	Profile E-2 or better, etc $\overline{\text{CC}}$ 20/40, 20/70 or 20/30, 20/100 or 20/20, 20/400	$\overline{\text{SC}}$ No Standard $\overline{\text{CC}}$ 20/- 20/40	+8.00 -8.00	Same as Commission	X- - - - -	- - SAME	AS	COMMISSION - - -	- - - - - - - - -	- - - X

NOTE:
- When recording refractive error, record BVA and best Rx for the patient.
- Necessary use of contact lenses is disqualifying for all personnel. Wearing of C.L. is forbidden for Flying Class I, IA, II and III.
- Initial commission or enlistment examinees must have C.L. out for 21 days prior to exam. OK to use C.L. for periodic nonflying P.E.s.
- FALANT is acceptable if VTA-CTT unavailable. "Normal" color vision is defined as 10 or more correct on VTS-CV. Grade I defect OK for flying.
- Farpoint corrective lenses may be worn during accommodation testing for all classes.
- Glaucoma or preglaucoma is disqualifying for Class I and IA. Glaucoma disqualifying for all others.
- Manifest refraction need not be performed on examinees with 20/20, 20/20 Distant Unaided Acuity.

X - Means there is No Standard.

Exercise 4-11

Fill in the blank spaces. Use of Attachment 6 may be required.

1. In the PULHESX profile serial, only ______________________ is considered in figuring the "E" portion. Organic eye diseases and visual field impairments are profiled under the ___________________.

2. A patient's uncorrected distant visual acuities are OD 20/60 and OS 20/50. With his/her glasses on he/she sees OD 20/20 and OS 20/20. The patient's "E" profile is a ________________________________.

3. A patient's uncorrected distance visual acuities are OD 20/400 and OS 20/400. His/Her corrected visual acuities are OD 20/40 and OS 20/50. His/Her "E" profile is ________________________________.

4. Without glasses a patient's uncorrected distance visual acuities are OD 20/100 and OS 20/100. With his/her glasses on he/she sees OD 20/30 and OS 20/80 at distance. His/her "E" profile is ____________ ________________________.

5. The same patient in question 4 has an eye injury OS and his/her best corrected distant vision temporarily drops to OS 20/200. His/Her temporary profile is an __________________________. This would be entered on _____________________.

6. The PULHESX profile may be entered in Item __________ of the SF __________ as well as the AF Form 422.

Technical Training

Optometry Specialist

BLOCK V

CLINIC MANAGEMENT AND PRACTICUM

March 1984

SCHOOL OF HEALTH CARE SCIENCES, USAF
Department of Biomedical Sciences
Sheppard Air Force Base, Texas 76311

Designed for ATC Course Use

RGL:11.0

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SW J3ABR91235-000-V-3b	Visual Screening	26 - 31

This supersedes SW J3ABR91235-000-V, January 1983. Previous editions may not be used.

Department of Biomedical Sciences
School of Health Care Sciences, USAF
Sheppard Air Force Base, Texas 76311

SW J3ABR91235-000-V
March 1984

CLINIC MANAGEMENT

This study guide and workbook (SW) is designed to give you fundamental knowledge in the management of the optometry clinic.

OBJECTIVES

V-2a. Given WS J3ABR91235-000-V-2a, identify OPSEC vulnerabilities of AFSC 912X5 with 70% accuracy.

V-2b. Given WS J3ABR91235-000-V-2b, identify medical material procedures with 70% accuracy.

V-2c. Given WS J3ABR91235-000-V-2c, identify basic facts about the eye safety program with 70% accuracy.

INTRODUCTION

You have learned many things relating to Optometric Technology in the past few weeks, much of which you will use daily in your clinic. However, no matter how proficient you are in spectacle ordering, visual fields, or color vision testing, your success as an Optometry Specialist will be determined primarily by your ability to communicate with people and to manage your clinic. This unit of instruction is designed to deal with subject matter that will assist you in clinic management.

OPERATIONAL SECURITY

INTRODUCTION

Quite obvious to us is the importance of the completion of the Optometry Clinic's mission to the entire Air Force. However, all the subtle, hidden acts that can interfere with the accomplishment of our mission are not so obvious. We have a tendency to work with patients and see them as patients without realizing how important they are to the continued operation of an Air Force Base, an Air Force Major Command, or the Air Force proper. Neither do we realize how important we are, singularly, to the unit and the Air Force mission. In no way can we hope to cover every facet of Operations Security (OPSEC) but we will look at some major applications and you will realize how personal OPSEC actually is.

INFORMATION

OPERATIONS SECURITY

1. Terms explained:

a. Operation. For the purpose of this regulation, an operation refers to any military activity, exercise, function, project, program, or event which requires the protection of information to deny a potential enemy either a tactical or strategic advantage. Specifically included are any support activities (logistic, research and development, training, and others) which may contain intelligence indicators that would reveal operational capabilities or intentions when properly collated and analyzed.

b. Operations Security (OPSEC). The protection of operations resulting from the identification and subsequent elimination or control of intelligence indicators susceptible to hostile exploitation. The purpose of OPSEC is to prevent the disclosure of information containing intelligence indicators that can be used to degrade operational effectiveness.

c. Intelligence Indicator. An item of possible intelligence value that can provide information about capabilities and intentions when properly interpreted.

d. Operations Security Board. A panel composed of representatives from major operations and support staff areas. The OPSEC board functions as a reviewing agency for the organization's OPSEC program, establishes objectives, and assesses OPSEC program effectiveness.

e. Operations Security Survey. A method used to evaluate the protection afforded a given operation. The OPSEC survey is characterized by multiple functional outline identifying possible sources of information disclosure. Functional outlines include:

(1) Communications. An identification of who talks to whom, what is said, how the transmission is made,and when it occurs in relations to the planning and execution of an operation.

(2) Communications Security (COMSEC). An identification of all COMSEC measures and materials available for a given operation and an evaluation of their application.

(3) Electromagnetic. An identification of electromagnetic emmitters associated with an operation including their deployment, probable emmission patterns, and times of activation in relation to significant events of an operation.

(4) Electronics Security (ELSEC). An identification of all ELSEC measures and materials available for a given operation and an evaluation of their application.

(5) Intelligence Threat. An identification of known and potential enemy capabilities and exploit information from a given or similar operation. This threat analysis would include an assessment of enemy human intelligence efforts, signals intelligence, reconnaissance satellite capabilities, and previous related intelligence efforts and their results.

(6) Operations. An identification of all participants in an operation, their actions, and the time those actions occur in relation to the execution of the operation. It also includes assessment of operational procedures to ascertain whether stereotyped or predictable patterns are discernable.

(7) Physical Security. An assessment of all physical security measures taken to safeguard classified equipment, material, and documents.

(8) Supplemental Data. An identification of support functions relating to or supporting an operation (for example, logistics, personnel, and administration) and an assessment of the intelligence indicators they may contain.

2. OPSEC Policy:

a. Successful operations frequently depend upon the concealment of capabilities and intentions. OPSEC involves protecting various forms of information which may contain intelligence indicators of value to hostile elements attempting to determine these capabilities and intentions. This protection must be applied through all stages of an operation, from its conception and planning to postoperational evaluation.

b. Both classified and unclassified information must be protected to provide security for operations. Classified information is protected in accordance with established information security programs. Unclassified information can be afforded appropriate protection by applying OPSEC principles, policies, and techniques.

c. The commander's emphasis is required to ensure the OPSEC is considered to the maximum extent practicable at all levels and in all operations. It is not necessary that a commander be involved in "operation", as generally defined, for OPSEC requirements to apply. As a minimum, commanders are responsible for ensuring that members of their command are trained in OPSEC techniques and requirements, and for determining the degree to which OPSEC considerations apply to their organization. Many activities, such as developing training curricula, preparing management directives, and coordinating logistics movements can reveal valuable information to hostile agencies if not properly protected. The OPSEC program can help provide that protection.

3. OPSEC Concept:

a. The first formal OPSEC was developed to protect Southeast Asia operations. The OPSEC survey proved to be a valuable tool in the overall OPSEC program. It provided a systematized means to identify and eliminate enemy sources of information.

b. Emphasis on OPSEC must continue during peacetime. This emphasis is maintained by developing a strong OPSEC training program, by using sound OPSEC principles, by stressing enemy intelligence collection capabilities and by conducting OPSEC surveys of various peacetime operations such as exercises, unit movements, systems development, and logistics support. Additionally, continuous command is required to assure that plans, procedures, and training encompass imaginative and practical OPSEC considerations, and that personnel are motivated to employ effective OPSEC principles.

c. OPSEC, COMSEC, information security, and physical security are interrelated and mutually supporting programs. However, OPSEC has broader application in that it seeks to protect necessarily unclassified and otherwise highly visible aspects of an operation as well as classified aspects. It makes little sense to protect an operation by classifying some parts of it, or to expend COMSEC resources protecting information about it, when unclassified conversations, stereotyped procedures, and other readily available data could provide an enemy with meaningful intelligence indicators. An effective OPSEC program will eliminate or control many of these indicators.

d. OPSEC must be a matter of continuing concern throughout the life of an operation.

(1) Specific operations orders, programs, standing operating procedures, and supporting plans and procedures must be:

(a) Developed with the awareness that the enemy can identify and exploit vulnerable activities.

(b) Designed to provide the highest possible degree of security without degrading the effectiveness or safety of an operation

(c) Designed to degrade or deny to the enemy sources of information vulnerable to exploitation. In order to degrade the validity of the sources of information, the use of counterintelligence activities and deception should be considered, where appropriate.

(2) Security safeguards must be continued through the execution phase of an operation. This effort includes appropriate supervision to ensure that sound OPSEC practices are followed during execution as well as during planning. OPSEC survey techniques and assistance from other agencies may be helpful in their supervision.

(3) In the same manner, the critique and reporting phases of an operation can yield valuable intelligence to an enemy if OPSEC principles are not continued.

4. Objectives of the Air Force OPSEC Program:

The principal objective of the Air Force OPSEC program is to enhance mission effectiveness by achieving and maintaining at an optimum level of overall security in all Air Force operation. Major goals of the program are:

a. To identify and control OPSEC weaknesses by developing and maintaining the capability of conducting effective OPSEC surveys and by taking appropriate corrective actions on the findings of those surveys.

b. To establish and maintain effective OPSEC training programs for both individuals and units.

5. Schedule:

Uniquely, we in the Optometry Clinic support any operation in effect on the military installation to which we are assigned. Our patients are members of the Air Force who are TDY to the installation. Our patients are from all ranks, and all operations represented on those installations while its effect on operations may be less obvious, consider the appointment schedule and this question, "Who needs to know that the installation commander has an appointment in Optometry at 1330?" All things considered, who really needs to know who is being treated and their treatment times? Information even as minor as this is a valuable asset to anyone attempting to degrade and operation.

6. Equipment:

Another area for our consideration is that Optometry Clinic operations are accomplished through an intact, fully equipped treatment facility. Therefore, the loss of one item can degrade our operation and the operation whose working staff are our patients. We must realize that our treatment equipment is quite vulnerable to sabotage when it is in a treatment area and we are not there with it.

7. Patients, Staff and Facilities:

Lastly, your instructors have continually reminded you to check your work, be sure what you do is correct to ensure the safety of the patient. All of us who work in the Optometry Clinic are responsible for the well being of our patients; therefore, we must realize how easily an act of sabotage can be accomplished against our patients. We must also realize how far-reaching and severe the effects of the sabotage might be, not only to the patient but also to the specialists, technicians, optometrists, other patients, observers, and the facility. What we must be continually alert for cannot be stated exactly but some acts could be as simple as switching a bottle of short-term cycloplegic with a bottle of Atropine and incapacitating (visually) the patient for two weeks, or switching pairs of glasses so that two patients receive the wrong Rx and perhaps have a car accident when driving home from the hospital. These are just a couple examples, but if the operation of the Optometry Clinic is interrupted, consider the effect on the mission of the hospital which has lost a major function. Its mission of returning a patient to fullest possible job performance as quickly as possible is greatly impaired. We can now see the devastating effects upon the total Air Force mission when there is a loss of any operation.

Summary

It is of great importance to our country that each military member be made aware of OPSEC and the vulnerability of operations to degradation at any level. We must also be aware of the serious consequences brought about by the loss of an operation that may be considered minor to actual combat operations.

EXERCISE V-2a

INSTRUCTIONS

Complete the following statements.

1. Important information can be obtained about who is being treated from a presumably innocent source. The optometry clinic ____________________ could provide this information unless safeguarded.

2. Our treatment equipment may be subject to ____________ when in a treatment area unattended.

3. Besides safeguarding equipment, operations security requires protection of ______________, staff, and facilities.

4. Interrupting the optometry clinic function would greatly reduce the mission of the ________________.

PUBLICATIONS AND SUPPLY MANAGEMENT

LOCATING USAF SUPPLIES

Since most of the medical and non-medical supplies that you will use are procured from the military supply depot, you will spend countless hours perusing over catalogs and other such publications. The first step then, in the procurement of supplies will be to learn about the publications in which they are contained, how these publications are used, and how to obtain different military and civilian publications.

AIR FORCE PUBLICATIONS

How does a multi-million dollar business, spread across the entire globe, communicate with each of its individual branches? With today's vast development in communications, there are many ways. The most reliable method obviously is through written documents. They are relatively safe and can always be kept for reference. The Air Force calls these written communiques publications. In your duties, you will be working with many publicatiions and forms; therefore, you must be familiar with this subject. Success in your job depends, to a large extent, on your ability to locate and use publications.

Air Force publications may be defined as the communications media through which the Secretary of the Air Force, and various echelon commanders announce policies, prescribe procedures, and furnish instructions and information necessary to accomplish the Air Force mission.

Air Force commanders and staff officials at all organizational levels within the Air Force have a continuing need to communicate written policies, procedures, and information to personnel under their jurisdiction. A publication is the most reliable, effective, and economical medium to communicate information which is going to affect many people or organizations. Another advantage of the publication is that it can be kept conveniently available for future reference.

CLASSES OF AIR FORCE PUBLICATIONS

Air Force publications are divided into two general classes:

(1) Departmental and (2) Field.

Departmental Publications. Departmental publications are issued by, or for, HQ, USAF and one or more major air commands or to HQ USAF alone. An example of a departmental publication would be AFM 168-4, Administration of Medical Activities.

Field Publication. Field Publications originate at major air command level or below and are used only within the issuing activity. An example of a field publication would be TACM 168-4.

Types of Air Force Publications

Within the two general classes of publications listed above are standard publications such as regulations, manuals, and pamphlets. These may be issued at either departmental or field level. Although there are other types of publications, for now you need concern yourself only with these three:

REGULATIONS

Regulations are used to announce policies, assign responsibilities, direct actions, and prescribe procedures. Regulations are normally permanent directives. For example, a regulation is considered permanent if in effect for 18 months or more. Regulations may contain an expiration date of 18 months or more after date of issuance. Those of a temporary nature may contain an expiration date--not later than 18 months from date of publication.

Manuals

Manuals are formerly used in the same manner as regulations, but for more voluminous procedural material. They contained permanent and detailed instructions, procedures, and techniques telling personnel how to perform their duties. However, manuals are currently being converted to regulations. For example, the step-by-step procedure for preparing a performance report for enlisted personnel was formerly covered by AFM 39-62, Noncommissioned Officer and Airman Performance Reports. The step-by-step procedure is now covered by AFR 39-62, Noncommissioned Officer and Airman Performance Reports. Training manuals that are primarily informational or instructional are being converted to pamphlets instead of regulations.

Pamphlets

Pamphlets are handbooks, booklets, or brochures containing informative and instructional rather than directive material. They are usually issued as a brochure and may be written in an informal style to create and maintain reader interest. They are permanent in nature but may contain an expiration date. AFP 50-34 MTS/PFE study guide is one you'll become familiar with in a few years.

Numbered Letters

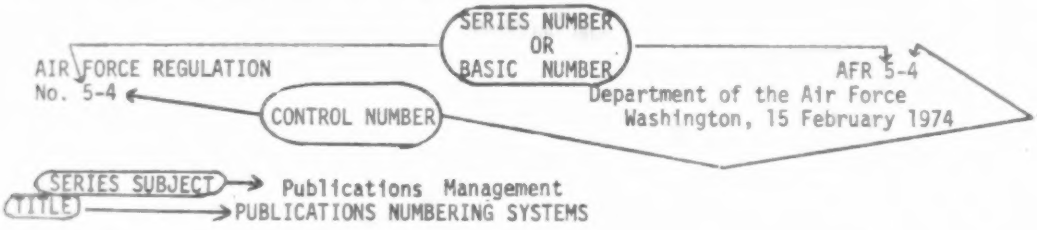
Numbered letters are temporary and contain a statement announcing expiration within 18 months. The numbered letter provides a fast and economical medium for issuing temporary material, announcing new or changed policy procedures, or instructions not directly related to an existing publication. Material changing in an existing publication will be issued as a standard change to that publication.

LOCATION OF PUBLICATIONS THROUGH THE USE OF AFR 0-2, SUBJECTIVE AND NUMERICAL INDEX OF STANDARD PUBLICATIONS AND RECURRING PERIODICALS

1. Of the many departmental indexes of publications, AFR 0-2, the numerical index of publications, gives the most information about each publication and will be your most frequently used index. AFR 0-2 provides you with an alphabetical listing of the basic subject series and a numerical listing of each publication subject and title.

2. The numerical listing of AFR 0-2 is arranged by publication series. The series number is a reference to the subject of the publication. For example, all publications dealing with medical administration are numbered 168 and are referred to as the 168 series.

3. In addition to the series number, each publication has a control number, preceded by a dash (example, 168-1, 168-2, etc.). Control numbers are assigned in sequence beginning with a number "1" for each series. There may be three types of publications (Regulations, Manuals, and Pamphlets) assigned to each control number. Each of the three types will not always be assigned, but if all three are assigned they will be listed Regulations first, Manuals second, and Pamphlets third. (Example: R168-4 followed by M168-4, or R168-1 followed by P168-1 when there is no manual assigned control number 1). Figure 1-1 futher amplifies the publications numbering system.


SERIES NUMBER OR BASIC NUMBER
AIR FORCE REGULATION
No. 5-4
CONTROL NUMBER
AFR 5-4
Department of the Air Force
Washington, 15 February 1974
SERIES SUBJECT
Publications Management
TITLE
PUBLICATIONS NUMBERING SYSTEMS

Publications Numbering System

Figure 1-1

4. From Figure 1-1, we can tell a great deal about AFR 5-4. First, we know that it is a departmental publication because of the "AF" in AFR. Secondly, we know that the type of publication is regulation because of the "R". Thirdly, we know that this is the fourth publication published in the 5 series because of the "4" in AFR 5-4.

5. If our example in Figure 1-1 had been TACR 5-4, then we would know that this is a field publication and that in order to find out its title we would have to check TAC regulation 0-2, which is the numerical index for Tactical Air Command Publications. Because one publication cannot duplicate information contained in another publication, TACR 5-4 would not be the same as AFR 5-4 and could even apply to a completely different area than AFR 5-4. However, if TAC would like to clarify or add to AFR 5-4, it could issue a supplement to this publication. Supplements are always issued at a command level which is subordinate to the echelon of command that published the original. Publication changes, however, are issued at the same echelon of command which issued the original.

6. As an example of how the AFR 0-2 format is used to locate a publication, let us suppose that you are due for a promotion in the near future and you would like to look up the directive which covers promotions. You would first look in AFR 0-2, page 2. This index is alphabetical but you would look under the general heading "Enlisted Personnel" to find promotions. "Enlisted Personnel" is the heading for the 39 series. Turn to the 39 Series in the 0-2 and see that "Promotion of Airmen" is listed opposite "R 39-29". This means that information on airmen promotion can be found in AFR 39-29.

HOW TO REQUEST PUBLICATIONS

Air Force Publications

You know what publications are and how they are numbered and listed in AFR 0-2; now how do you get them?

The Chief of Administration in charge of the Administrative Services Office (ASO) is responsible for supervising all official publications used in your medical facility. Each section within the medical facility must establish its publications requirements with this office. You, as a supervisor wanting a publication must send a requisition to the ASO listing the publication number, title, justification, and number of publications required. The ASO will review the list for essentiality and then consolidate the requirements from all sections. ASO then orders each basic publication (including its changes to date) and prepares a separate request to have your hospital included on the series distribution list at the Publications Distribution Office. This gives assurance that you will be included when new changes to your publication come out.

Civilian Publications

When there is a need for civilian publication, e.g., a medical reference book, visual science dictionary, etc., you should do one of the following:

1. If your hospital has a medical library, you would submit a request to the librarian. Although the exact format of your request may vary according to local policy, generally the librarian will need the following information:

   a. Stock number (if applicable).

   b. Description (title, edition, author, and publisher).

   c. Unit cost.

   d. Number required.

   e. Justification (in narrative form - short paragraphs).

2. If your hospital does not have a library, civilian publications are usually ordered through medical supply. Check your local policy for the exact procedure.

MEDICAL MATERIEL PROCEDURES

AIR FORCE ACCOUNTABILITY

When you joined the Air Force you took on a major responsibility. Air Force accountability, in reference to medical materiel, says you are responsible for the care of any government item you handle. The hospital, clinic or any item in it must be used properly. If you lose or break any governement item while you are using it, the responsibility then becomes yours. Either you justify your actions or pay for the item. If you observe someone mistreating the facility or equipment it is your responsibility to bring it to the attention of the proper authorities. Every individual in the Air Force is held accountable for all government equipment they use. The importance of this responsibility cannot be over emphasized. This concept is explained thoroughly in AFR 67-10.

Property Accountability

Accountability means responsibility and as you know there are several kinds. Let us look at just two kinds; supervisory and custodial.

Supervisory responsibility is that of, but not limited to, training and safety. It is the supervisor who trains new personnel on the equipment. Training will also come into play when a new piece of equipment arrives. Everyone will be taught how to use the equipment correctly and safely by the supervisor. Speaking of safety and property, if something becomes hazardous to use, it is the supervisor's responsibility to be aware of what to do about it.

Custodial responsibilities go with the job of property custodian. A property custodian is an officer, a warrant officer, NCO, airman or civilian employee who is responsible for all property issued to or in possession of a ward, clinic, section or department. The custodian is usually the NCOIC (Non Commissioned Officer in Charge), but when possible it may be delegated to other personnel to relieve the NCOIC of the extra duty.

The property custodian will be appointed by the Director of the Base Medical Services and assigned an account symbol to indicate the location of all equipment. The property custodian will be held directly responsible for all equipment listed on the clinic custody receipt. The letter of appointment as custodian is made in two copies. One goes to supply and one stays in the clinic.

Before ever taking the job as property custodian you must insure that a full inventory of all equipment is taken. When a piece of equipment listed is not physically present or it is damaged, DO NOT SIGN the custody receipt/location list. The custodial action list should reflect any changes in the inventory. Only when the missing or damaged equipment is documented should you sign the inventory. Once you have signed and are officially the custodian, the ordering, signing for and projecting future needs of equipment becomes your duty.

Another duty of the property custodian is to appoint a supply representative. The job requires that the one selected be able to perform in the absence of the custodian, the custodial duties. The letter of appointment is sent to supply and a copy is kept in the clinic also. The reason for sending the letter to supply is fundamental. They can't allow anyone, unknown to them, to pick up supplies and equipment charged to an account unless that person is a bonified representative of the account.

Prepare a Budget

Before getting into the discussion of ordering medical supplies or equipment we better know something about how we will buy them.

Preparation of a budget will need to be coordinated, first, with the hospital Resource Management Office (RMO). Resource Management can refer to the past Project Fund Management Record (PFMR) which will show the trends in spending. The PFMR breaks down the spending into FY Quarters. From this information you determine your present and projected needs of supplies and equipment. RMO then decides on the amount of money you may use per quarter for one year in advance.

Once your budget is established you must stay within it. Those times when you go beyond your budget projection creates problems for both supply and your clinic. Supply either returns the orders to Base Supply or RMO takes money out of someone elses account which puts them short. To budget is to plan intelligently.

How will you do all this ordering of supplies and equipment? Most of the ordering will be done via the Federal Supply Catalogs. There are many Federal Supply Catalogs containing items peculiar to different needs, so which one do you use? First, refer to the 6500-AL. The 6500-AL is an alphabetical index for medical materiel that tells you which class/group an item may be located in. The two identification lists (IL) catalogs you'll be using are:

6540-IL	Opticians' Instruments, Equipment and Supplies, i.e. lensometers, pliers, frames and temples
6515-IL	Medical and Surgical Instruments, Equipment and Supplies, i.e. slit lamps and phoropter and chair

In the Air Force supply system, identification of an item is accomplished by both name and number. However, procurement requests for items under $300 contain only the number of the item. The 13-digit National Stock Number is comprised of a 4-digit Federal Supply Classification (FSC), a 2-digit NATO code number, and a 7-digit National Item Identification Number (NIIN), as shown below in Figure 1-2.

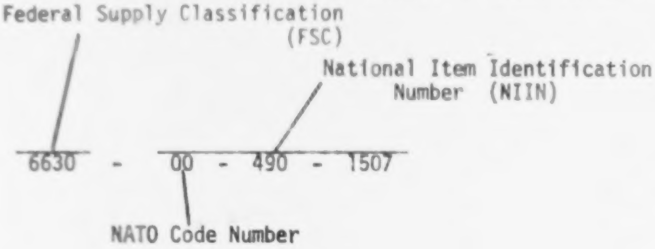

Federal Supply Classification (FSC)
National Item Identification Number (NIIN)
6630 - 00 - 490 - 1507
NATO Code Number

Figure 1-2

The NATO code number identifies which country is to be charged for the item. In the example Figure 1-2 "00" represents the good ole United States. Other NATO countries may purchase from our federal stock catalogs. The countries are identifed by the NATO code number

The NIIN or last 7 digits uniquely identify the supply item. In other words, only one specific item in the supply system will end in that specific 7 number sequence.

In the Federal supply system, identification of a group of items is accomplished by the Federal Supply Classification (FSC) which is the first 4 digits of the stock number which, as mentioned, are what you'll find in the 6500-IL beside the name of the item you are looking for. Along with Identification Lists (IL) are Management Lists (ML).

The Identification List and Management List are published separately, but used together are considered to be a Federal Supply Catalog.

Identification List (IL). The Identification List is published according to FSC and identifies items by name, picture and an accompanying description along with the National Stock Number. Each identification list also contains an alphabetical index and a stock number index of the items it contains which may be used for cross-referencing items.

Management List (ML). The Management List give supply management data by National Stock Number.

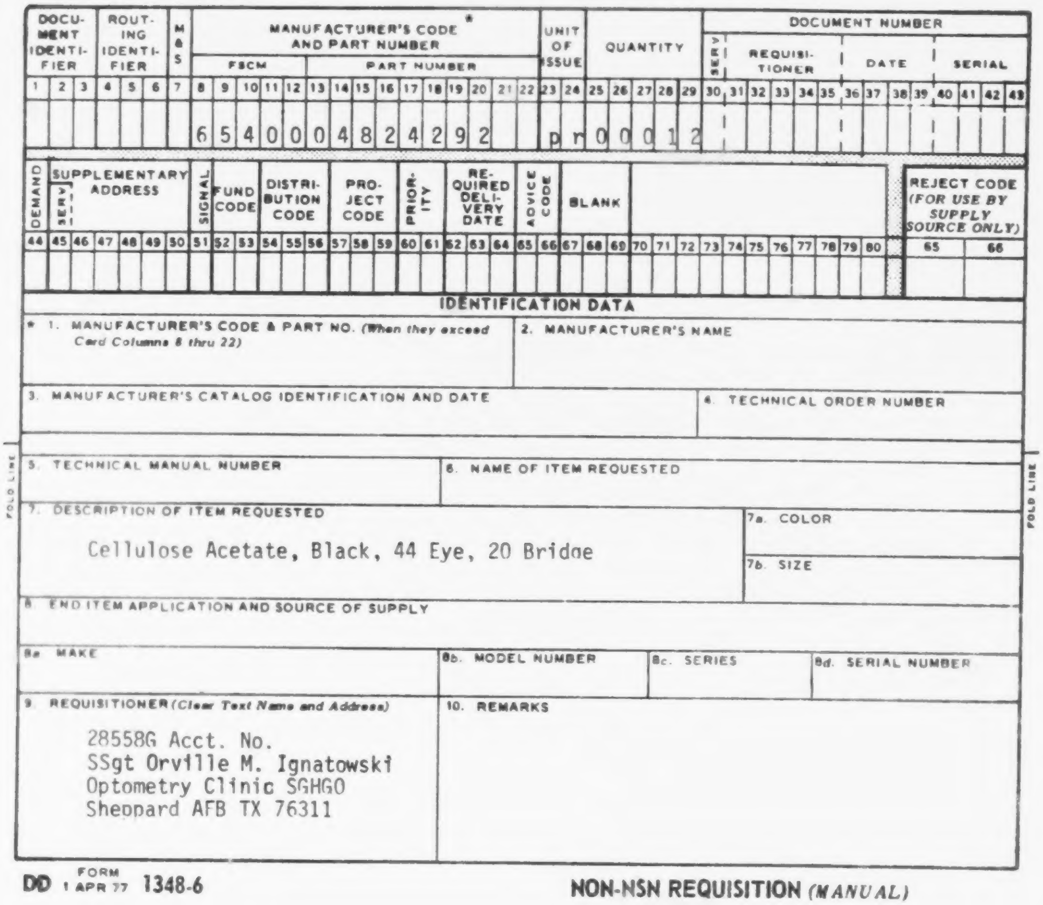
1. Price
2. Unit of issue -- i.e., pair, each roll, set, etc.
3. Packaging and packing information
    a. Intermediate package quanity
    b. Exterior container quantity
4. Weight and cubage

Another commonly used supply catalog is the General Services Administration (GSA) which contains supply information on many office and expendable supplies used throughout the federal government.

CIVILIAN SUPPLY CATALOGS. When you are unable to find a specific item in one of the Federal Supply catalogs, it may then be necessary to use a civilian catalog. You should not procure items from civilian catalogs if a satisfactory item is available through the Federal supply system. This is because items ordered through a civilian catalog are more expensive than from the Federal supply system. The same basic ordering procedures apply to a civilian catalog as they do to the Federal supply catalogs. Medical materiel usually keeps a good selection of civilian supply catalogs for you to use when researching an item not found in the Federal Supply Catalog.

Initiating Requests for Supplies

Once a requirement has been established for a particular item (new items or replacement item) you must submit a formal request. Requests must include all pertinent data affecting choice or variations. At this time it should be established that supplies are items costing no more than $299.00 The request will follow one of three ways. First, if the item is stock listed (having the 13 digit Federal stock number) then a DD Form 1348-6 NON-NSN REQUISITION (Figure 1-3) would be filled out. Policies on completion of this form vary from hospital to hospital but Figure 1-3 gives a sampling of minimum information for a stock listed item. The sample shows simply the stock number, unit of issue as pair (pr), quantity as 12, the items description in Box 7, Box 9 shows the clinic account number, person authorized to order and clinic address.



DOCUMENT IDENTIFIER	ROUTING IDENTIFIER	M & S	MANUFACTURER'S CODE AND PART NUMBER *		UNIT OF ISSUE	QUANTITY	DOCUMENT NUMBER			
			FSCM	PART NUMBER			SERV	REQUISITIONER	DATE	SERIAL
1 2 3	4 5 6	7	8 9 10 11 12	13 14 15 16 17 18 19 20 21 22	23 24	25 26 27 28 29	30	31 32 33 34 35	36 37 38 39	40 41 42 43
			6 5 4 0 0	0 4 8 2 4 2 9 2	p r	0 0 0 1 2				

DEMAND	SUPPLEMENTARY ADDRESS		SIGNAL	FUND CODE	DISTRIBUTION CODE	PROJECT CODE	PRIORITY	REQUIRED DELIVERY DATE	ADVICE CODE	BLANK		REJECT CODE (FOR USE BY SUPPLY SOURCE ONLY)	
	SERV												
44	45	46 47 48 49 50	51	52 53	54 55 56	57 58 59	60 61	62 63 64	65 66	67 68 69	70 71 72 73 74 75 76 77 78 79 80	65	66

IDENTIFICATION DATA

* 1. MANUFACTURER'S CODE & PART NO. *(When they exceed Card Columns 8 thru 22)*

2. MANUFACTURER'S NAME

3. MANUFACTURER'S CATALOG IDENTIFICATION AND DATE

4. TECHNICAL ORDER NUMBER

FOLD LINE

5. TECHNICAL MANUAL NUMBER

6. NAME OF ITEM REQUESTED

7. DESCRIPTION OF ITEM REQUESTED

Cellulose Acetate, Black, 44 Eye, 20 Bridge

7a. COLOR

7b. SIZE

8. END ITEM APPLICATION AND SOURCE OF SUPPLY

8a. MAKE

8b. MODEL NUMBER

8c. SERIES

8d. SERIAL NUMBER

9. REQUISITIONER *(Clear Text Name and Address)*

28558G Acct. No.
SSgt Orville M. Ignatowski
Optometry Clinic SGHGO
Sheppard AFB TX 76311

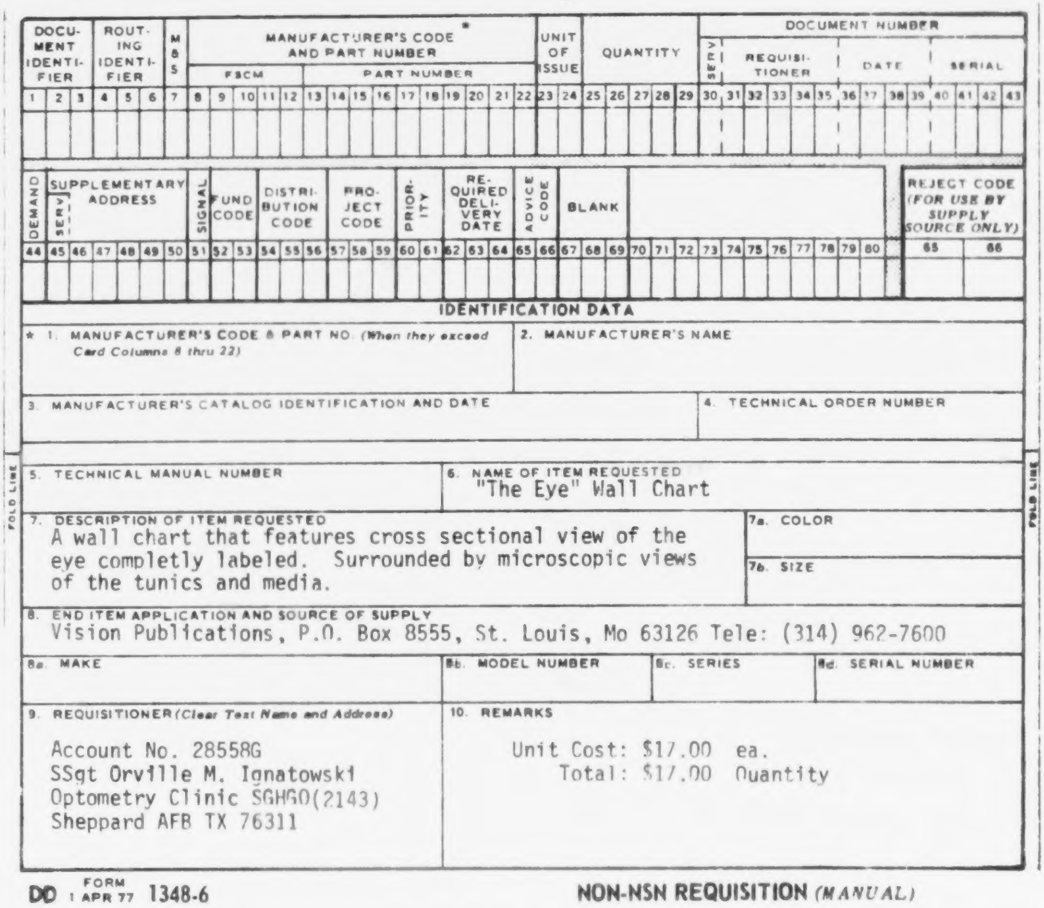
10. REMARKS

DD FORM 1 APR 77 1348-6

NON-NSN REQUISITION *(MANUAL)*

Figure 1-3

As promised, the second way is accomplished if the supply item is non-stock listed. Again, you will use a DD Form 1348-6 but with more details about the item and where it may be obtained. Remember, it is non-stock listed so there will not be a stock number. Also the amount of information the different hospital supply departments need changes from place to place. On Figure 1-4 is sampling of minimal information for a a non-stock listed item.



DOCUMENT IDENTIFIER	ROUTING IDENTIFIER	M & S	MANUFACTURER'S CODE AND PART NUMBER * (FSCM / PART NUMBER)	UNIT OF ISSUE	QUANTITY	SERV	DOCUMENT NUMBER: REQUISITIONER	DATE	SERIAL
1-3	4-6	7	8-22	23-24	25-29	30	31-35	36-39	40-43

DEMAND	SERV	SUPPLEMENTARY ADDRESS	SIGNAL	FUND CODE	DISTRIBUTION CODE	PROJECT CODE	PRIORITY	REQUIRED DELIVERY DATE	ADVICE CODE	BLANK		REJECT CODE (FOR USE BY SUPPLY SOURCE ONLY)
44	45	46-50	51	52-53	54-56	57-59	60-61	62-64	65-66	67-69	70-80	65 66

IDENTIFICATION DATA

* 1. MANUFACTURER'S CODE & PART NO. *(When they exceed Card Columns 8 thru 22)*

2. MANUFACTURER'S NAME

3. MANUFACTURER'S CATALOG IDENTIFICATION AND DATE

4. TECHNICAL ORDER NUMBER

5. TECHNICAL MANUAL NUMBER

6. NAME OF ITEM REQUESTED
"The Eye" Wall Chart

7. DESCRIPTION OF ITEM REQUESTED
A wall chart that features cross sectional view of the eye completly labeled. Surrounded by microscopic views of the tunics and media.

7a. COLOR

7b. SIZE

8. END ITEM APPLICATION AND SOURCE OF SUPPLY
Vision Publications, P.O. Box 8555, St. Louis, Mo 63126 Tele: (314) 962-7600

8a. MAKE

8b. MODEL NUMBER

8c. SERIES

8d. SERIAL NUMBER

9. REQUISITIONER *(Clear Text Name and Address)*

Account No. 28558G
SSgt Orville M. Ignatowski
Optometry Clinic SGHGO(2143)
Sheppard AFB TX 76311

10. REMARKS

Unit Cost: $17.00 ea.
Total: $17.00 Quantity

FOLD LINE

DD FORM 1 APR 77 1348-6

NON-NSN REQUISITION *(MANUAL)*

Figure 1-4

Now that the DD Form 1348-6 is completed the next item is the "Letter of Request for Local Purchase." This is another letter that varies in format but every supply needs some type of local purchase request. Figure 1-5 is a sample of one format. Take special note of item "m", indicate whether the item will be reoccurring or a one time order. The importance is budgeting again. Supply needs to plan for reoccurring items so if you'll need it more than once indicate such.

Medical Materiel tells us there are three steps to follow when an item is needed.

- Look in Federal Supply Catalogs - if not there
- Look in Civilian Catalogs which are available in Medical Materiel - when all information is at hand.
- Prepare DD Form 1348-6 and when applicable the Letter for Request.

LETTER OF REQUEST

SUBJECT: Request for Evaluation of Nonstocklisted Item for Local Purchase

TO: Local Purchase Review Committee

1. Request the following nonstocklisted item be reviewed for local purchase:

   a. Item description:

   b. Manufacture's Trade Name:

   c. Dosage:

   d. Manufacture's Model Number:

   e. Manufacture's Catalog Number:

   f. Manufacture's Name and Address:

   g. Source of Supply:

   h. Unit of Issue:

   i. Estimated price per unit of issue:

   j. Estimated usuage per month:

   k. A similar stocklisted item is not available

   l. Not applicable

   m. (Mention here as to whether the item is reoccurring or non-reoccurring)

PATRICK F. PHELAN, Maj, USAF, BSC
Optometry Clinic

The third way is from a "Shopping Guide". This is a computer listing of all recurring supply items. Things such as screws, frames, PD rules, temples, etc. Medical Materiel will send you this print-out in four copies. Why? There is one copy for your weekly orders. Simply underline, circle or check the items needed and send that copy to supply. Here again, watch the budget.

We've been talking about supplies for quite awhile but there are a couple of terms you might need to be familiar with. Supplies are either:

- Medical - solely used in the hospital environment, i.e. frames, eye patches, ophthalmic medications, etc.
- Non-Medical - can be used by any group medical or not, i.e. pencils, envelopes, paper clips, etc.

Remember these items will not cost more than $299.00.

EQUIPMENT

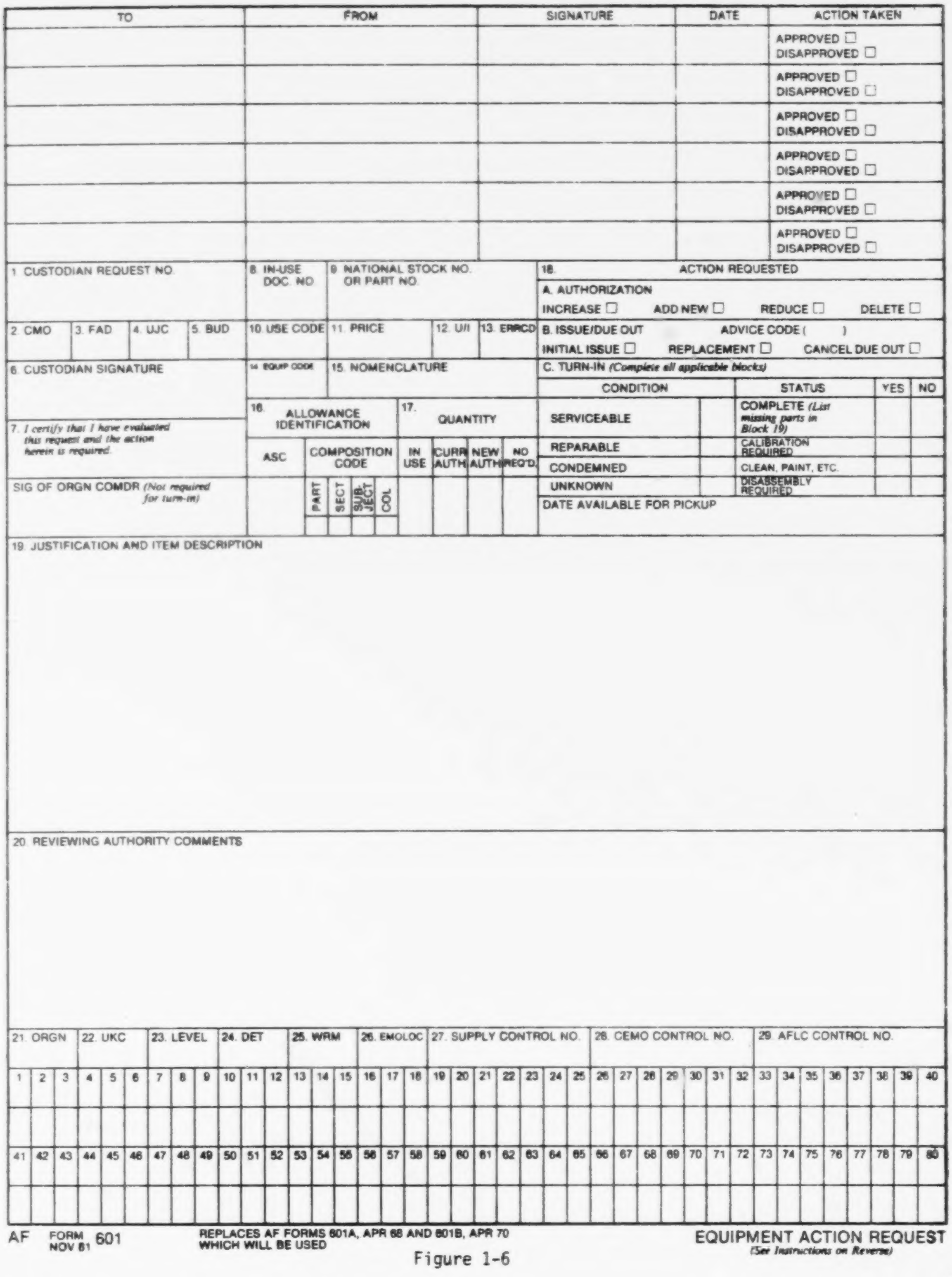
Supplies are not the only things clinics need. Equipment is essential also. Equipment items are broken down into two categories.

- Expense - costs anywhere from $300. to $2999.00, i.e. VTA-ND or Keystone
- Investment - cost over $3000.00, i.e. phoropter and chair

There are three factors that separate supplies from equipment and all three must fit for the item to be considered equipment.

1. Cost
2. Life expectancy must be at least 5 years.
3. Equipment retains its identity as it is used.

When the time comes to prepare a request for equipment you will use the AF Form 601. (Figure 1-6). One important thing to remember is that AF 601's should be turned in three years in advance. You might ask, How? Why? If you recall it was previously mentioned that equipment has a life expectancy so this is what you base your advance 601's on. This is when an Equipment Replacement Log will come in handy. This is a list of all equipment and life expectancy dates. The mistake so many make is that "Why order something I'll never get to use?" This may be true, but you can't just think of yourself now, you must think of the clinic and those that come after you.



TO	FROM	SIGNATURE	DATE	ACTION TAKEN
				APPROVED ☐ DISAPPROVED ☐
				APPROVED ☐ DISAPPROVED ☐
				APPROVED ☐ DISAPPROVED ☐
				APPROVED ☐ DISAPPROVED ☐
				APPROVED ☐ DISAPPROVED ☐
				APPROVED ☐ DISAPPROVED ☐

1. CUSTODIAN REQUEST NO.

8. IN-USE DOC. NO

9. NATIONAL STOCK NO. OR PART NO.

2. CMO | 3. FAD | 4. UJC | 5. BUD

10. USE CODE | 11. PRICE | 12. U/I | 13. ERRCD

6. CUSTODIAN SIGNATURE

14. EQUIP CODE | 15. NOMENCLATURE

7. *I certify that I have evaluated this request and the action herein is required.*

SIG OF ORGN COMDR *(Not required for turn-in)*

16. ALLOWANCE IDENTIFICATION					17. QUANTITY			
ASC	COMPOSITION CODE				IN USE	CURR AUTH	NEW AUTH	NO REQ'D.
	PART	SECT	SUB JECT	COL				

18. ACTION REQUESTED

A. AUTHORIZATION

INCREASE ☐ ADD NEW ☐ REDUCE ☐ DELETE ☐

B. ISSUE/DUE OUT ADVICE CODE ( )

INITIAL ISSUE ☐ REPLACEMENT ☐ CANCEL DUE OUT ☐

C. TURN-IN *(Complete all applicable blocks)*

CONDITION		STATUS	YES	NO
SERVICEABLE		COMPLETE *(List missing parts in Block 19)*		
REPARABLE		CALIBRATION REQUIRED		
CONDEMNED		CLEAN, PAINT, ETC.		
UNKNOWN		DISASSEMBLY REQUIRED		

DATE AVAILABLE FOR PICKUP

19. JUSTIFICATION AND ITEM DESCRIPTION

20. REVIEWING AUTHORITY COMMENTS

21. ORGN			22. UKC			23. LEVEL			24. DET			25. WRM			26. EMOLOC			27. SUPPLY CONTROL NO.							28. CEMO CONTROL NO.							29. AFLC CONTROL NO.							
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80

AF FORM NOV 81 601

REPLACES AF FORMS 601A, APR 68 AND 601B, APR 70 WHICH WILL BE USED

EQUIPMENT ACTION REQUEST

(See Instructions on Reverse)

Figure 1-6

In AFM 67-1, Vol V, Chapter 18, you will find explicit directions on completing the AF Form 601. There are also directions on the back of the form. The most important block is 19 and the "13-point" justification which goes on a separate sheet. Here is where you sink or swim so to speak. Your justification must be clear, concise,and worthy of consideration or the item may not get past the Equipment Review Authorization Activity (ERAA). This is a board of individuals who look at each AF601 in order to approve/dissapprove an item wanted. They work for the DBMS. When Expense equipment is reviewed the DBMS has the final approval. If approved the 601 goes to Medical Equipment Management Office (MEMO) and is placed in a folder to await funding. When the AF601 is for Investment Equipment and is approved the package then goes to command level and from there to the Surgeon General's office. Funding for investment equipment is item specific. This means the Surgeon General allocates money for each item approved , whereas Expense equipment is funded as a whole. Meaning a sum of money is allocated for Expense Equipment and sent to MEMO. MEMO looks at the categories of need which have been placed on the AF601's by the person ordering the items. MEMO then buys the equipment one by one on the list from the most needed to the least needed until the money runs out.

This is the answer to the "Why three years in advance?" If the Surgeon General doesn't pick your investment equipment to buy or MEMO runs out of money for your expense equipment you will have to wait for the next FY Defense Budget money.

The same AF Form 601 is used to Turn-In equipment also. The form indicates in block 18, item c just how to rate your old equipment. You need not do the 13-point justification or send it to the ERAA. Fill the form out where applicable and call Medical Maintenance. They will in turn categorize the item of equipment for you and send it to MEMO. Don't forget to place a copy in your equipment folder under Custodial Activities List to show the loss. If you don't, you might get charged for losing the equipment.

This brings us the important organization topic of maintaining an equipment custodial account. Supply should give you a special folder divided into sections. The first and most important is the appointment letter for the Custodian and Supply Representative. Next would be the Custody Receipt/Location list or inventory of all equipment you have or is funded and is on order and due in. From this list you will accomplish an annual equipment inventory. Another section will have your Custodial Log Sheet, listing equipment that has been ordered. The next section will contain the Custodial Activities list indicating gains in equipment not yet on inventory list. Last but not least is the Equipment Replacement Log which is optional, but good management. All this should keep you straight on your equipment.

Report of Survey

There may come a time in your life, as a custodian, a need for a Report of Survey. The report of survey is an investation into the circumstances related to the loss, damage, or destruction of Government property. It is conducted by a disinterested party called the Survey Officer. The Survey Officer may be an officer, or warrant officer. NCOs in grades of E-7 thru E-9 or civilians of equal rank may be appointed when there is insufficient officer strength available.

Now lets back up slightly and go over what may lead up to a Report of Survey. Say you came into the clinic some morning and noticed a piece of equipment missing. Call the Security Police and MEMO. MEMO will in turn cut an Inventory Adjustment Document showing the loss. This information is sent to the DBMS who will decide which route to take depending on the value of the equipment. If the item is over $500.00 and no one admits negligence, the DBMS orders a Report of Survey, DD Form 200, to determine what happened and who is responsible.

When the Report of Survey comes back to DBMS and to the base Resource Manager a decision is made. If willful negligence is determined then the value of the item can be taken from the guilty one's pay! If no negligence is found the Air Force absorbs the cost.

When the value of the equipment is less than $500.00 a Government Property Lost or Damaged (GPLD) report is filed and sent to the DBMS. The DBMS has the option to pursue investigation and to what extent someone will pay if negligence is proved. Fraud, Waste and Abuse is a serious offense.

EXERCISE V-2b

INSTRUCTIONS

Complete the following statements with one or more word.

1. Regulations are used to announce ____________, assign ____________, direct ____________, and prescribe ____________.
2. Manuals are used to provide ____________, ____________, and ____________ on how to perform duties.
3. Pamphlets are used as ____________, ____________, or ____________.
4. When observing destruction of government property, you should ______________________________ ______________________________.
5. Who is responsible if you lose or destroy a piece of government equipment? ____________
6. The two types of responsibilities concerning property are ____________ and ____________.
7. The property custodian is responsibile for both ____________ and ____________.
8. The Custody Receipt/Location list is also known as the ______________________.
9. With whom should you work when preparing a budget? ______________________
10. Budget funds will be broken down into ____________ and ____________.
11. The first four numbers of a National Stock Number are called the ______________________.
12. The last seven numbers of a National Stock Number are called the ______________________.
13. The list that gives a picture, description and name of the item is called the ____________.
14. The list that provides the price, unit of issue, etc. is the ______________________.
15. When items are not available in the Federal Supply System, you may order by ____________.
16. Supplies with a Federal Stock Number are ordered on a ______________________.
17. Supplies not listed with a Federal Stock Number are ordered on a ______________________.
    A ____________ of ____________ must also be submitted.
18. The justification for equipment must cover ____________ points.
19. Equipment should be ordered at least ____________ years in advance.
20. When a piece of government property valued over $500.00 is lost or damaged, a ____________ is requested.

OCCUPATIONAL VISION REQUIREMENTS

OBJECTIVE

Given WS J3ABR91235-000-V-2c, identify basic facts about the eye safety program with 70% accuracy.

INTRODUCTION

Eye safety is becoming more and more one of the hottest parts of occupational safety. Eye injuries are rapidly becoming the leading cause of blindness in the United States. Most of your involvement in the occupational eye safety picture will require no more training than that necessary to perform routine clinic duties. However, there are a few specific details that you alone as the Optometry Specialist must learn in order to be a member of the safety team.

AIR FORCE OCCUPATIONAL EYE SAFETY

Guidelines for occupational vision are in AF Occupational and Health Standards (AFOSH) 127-31. This directive identifies who is responsible for conducting the program and discusses eye hazardous areas, eye protection devices, and limitations for procuring these devices from a safety standpoint.

Functional managers and supervisors are the backbone of the eye safety program. The functional manager is the person who has managerial control of an activity. The supervisor is the individual appointed by the F.M. to lead, direct and supervise the work of others. They identify which jobs and work areas are eye hazardous. The base safety and bioenvironmental engineering personnel offer assistance by surveying the areas identified for the hazards present that require eye protection. The functional manager also helps determine the types of eye protection to be used. Supervisors, on the other hand, refer workers to the optometry clinic. Workers will be referred if they need prescription safety glasses and don't have them, if they complain of diminished or defective vision, or if the workers safety spectacles are poorly adjusted.

As you can see, your involvement in the safety program will primarily be that of scheduling patients for eye exams, and adjusting patients' safety lenses. AFOSH 127-31 states that all military and civilian employees who work in hazardous areas may get appointments in your eye clinic. You may wish to screen them first. If there isn't an optometrist assigned the patients may be referred to a civilian optometrist for examination at government expense.

PROCUREMENT OF SAFETY SPECTACLES

The procedures for the procurement of safety spectacles is contained in AFM 67-1, Vol II, part two, Amendment 53 (1 Sep 82). Recent changes in the program provide funding for safety spectacles through medical supply channels. Spectacles are local purchased, and the DD Form 771 is used to support the purchase request. Your responsibility will be the completion of necessary supply documents and the DD Form 771 for all safety glass orders. These ordering procedures, as well as other supply procedures will differ slightly in the forms used, but the basic tasks are the same.

The individuals working in eye hazardous areas may be referred to your clinic for any of the following reasons:

- They require prescription safety lenses and do not have them.
- Their safety spectacles are poorly adjusted.
- They complain of diminished or defective vision.

Prescription safety glasses may be repaired if the total cost of repair does not exceed 50% of the replacement cost of the glasses. Use common sense when requesting repairs. If the spectacles are in really bad shape or if the prescription is two or more years old, you should seriously consider a new eye exam and ordering a new pair of glasses.

Prescription safety glasses must meet either National Institute for Occupational Health and Safety (NIOSH) or American National Standards Institute (ANSI) standards. All patients' safety spectacles must have the Rx verified and adjusted. You must check to insure that the spectacles do in fact meet the above standards.

Finally, all occupational safety spectacles issued to the patient becomes the patient's personal property and no further accounting is needed.

EXERCISE V-2c

INSTRUCTIONS

Fill in the blanks with the correct answers. Minimum passing score is 70%.

1. The regulation that covers eye safety in the Air Force is AFOSH 127-31. This regulation gives the responsibility for identifying eye hazardous areas to whom? ______________________________ and

______________________________.

2. Who may receive eye exams at the base medical facility for the purpose of issuing safety glasses?

______________________________.

3. What form is used to support the purchase of safety glasses? ______________________________

4. Safety glasses may be repaired providing repairs do not exceed ____________________% of the replacement cost.

5. All safety devices used must meet either ____________________ or ____________________ standards.

CLINIC PRACTICUM

INTRODUCTION

This study guide and workbook is provided to give information on the following:

- o Appointment Systems
- o Patient Accounting
- o Visual Screening Procedures

INFORMATION

APPOINTMENT SYSTEMS AND PATIENT ACCOUNTING

OBJECTIVE

Given WS J3ABR91235-000-V-3a, select the required steps used to schedule appointments with 80% accuracy.

APPOINTMENT SYSTEMS

The scheduling of appointments should follow a well-planned and consistent format. Nothing adds more to clinic confusion and patient dissatisfaction than a mix-up in the appointment schedule. It is your responsibility to survey your clinic appointments to be certain that the patients are properly scheduled and to be sure that necessary time is allotted for doctors' leave, TDY, duty details, staff meetings, and holidays. This responsibility extends to you even if your clinic appointments are made at a centralized appointment desk remote from the eye clinic. In this case, coordination on a continuing basis with the central appointment desk is essential.

Many Air Force hospitals have a centralized appointment desk which relieves each clinic from making their appointments. The decision to make appointments through the clinic or by a centralized appointment desk is made by the Chief of Professional Services. If you do not make your own appointments, be sure to keep the list of appointments the central desk sends to you each day. This list should have walk-in patients added. At the end of the month the appointment list can be used for computing your professional activities report. The need for an accurate and complete activity report cannot be over emphasized. If you perform the work, account for it!

The Appointment Log

Basically, the appointment log is a patient control document. It allows for proper budgeting of time permitting quick service for those who need it most. It is poor management to fill the appointment log with patients who do not have a significant visual problem while causing some patient with a dire need for a complete vision examination to wait an inordinate time for an appointment.

The format of your log will vary somewhat with local requirements or desires when you are given permission to make your own appointments. The format can be any organized system which properly allots appointment time and indicates required information about the patient. As a minimum, the following information is required:

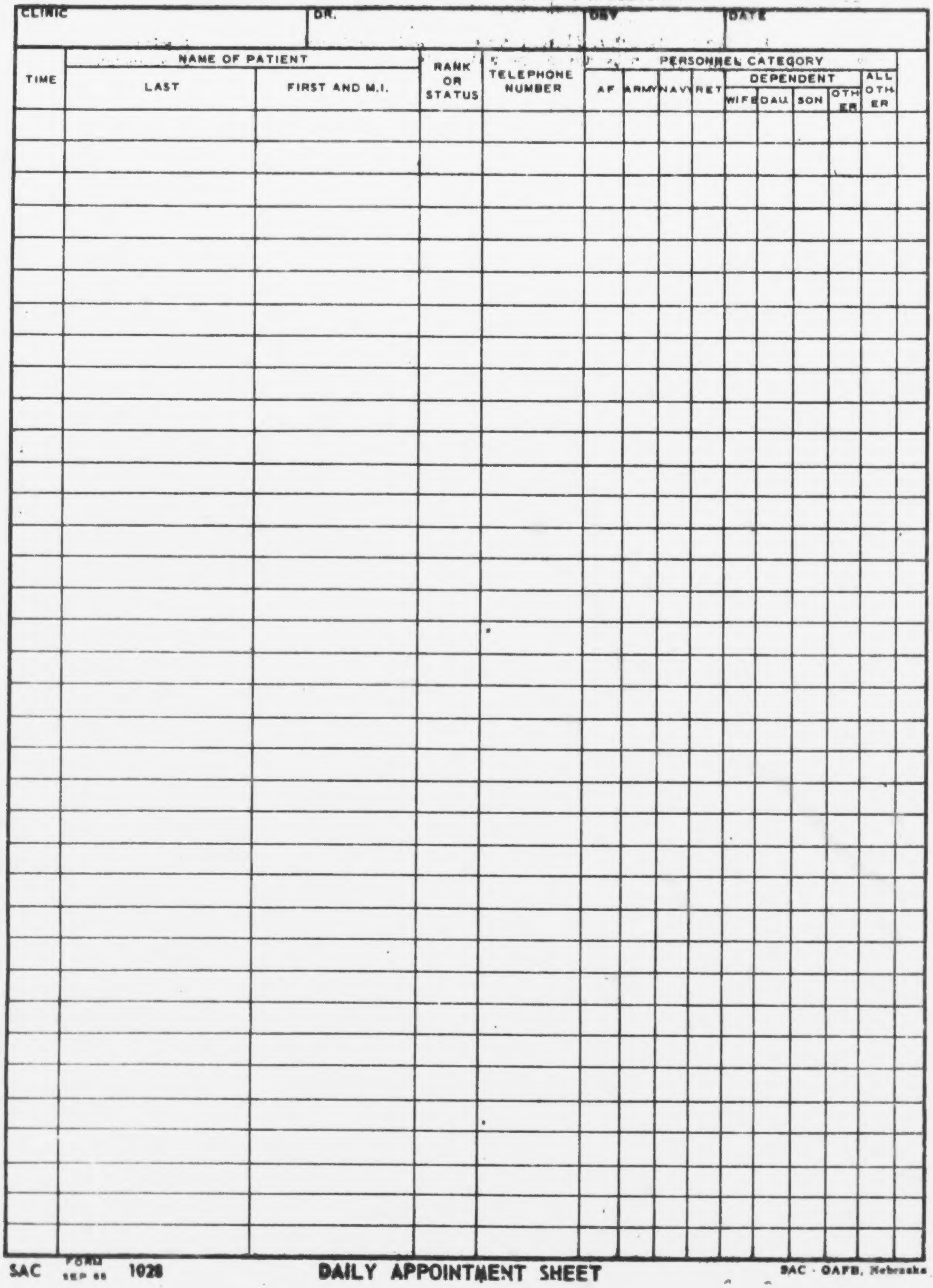
1. Date of the appointment
2. Time of the appointment
3. Name
4. Rank
5. SSAN
6. Squadron
7. Phone number
8. Purpose of the appointment, e.g., complete visual analysis, visual screening, revisit, etc.

If your clinic is staffed with more than one doctor, each will have a separate appointment log. If your clinic has an active visual survey (screening) program, a separate log should also be used for this type of appointment. The total time required by each patient is determined by the doctor.

However, the spacing of each appointment at any given medical facility could be directed by the hospital commander or Chief of Professional Services. If your clinic has some flexibility concerning your appointment schedule, you will soon learn to allot a length of time which is appropriate to the reason for the appointment. For example, someone needing a simple vision test for a state driver's license renewal would require only a few minutes of clinic time, while the patient in need of a complete examination and refraction would require considerably more clinic time. Also, you will find that a family of patients requires less time than the same number of individual appointments.

Policies on walk-in patients vary. Generally, speaking, walk-ins are handled on a case-by-case basis. Except for bonafide emergencies, walk-in patients should be encouraged to use the appointment system. However, these situations must be handled tactfully in order to avoid an incident. Use common sense in determining if the patient should be "worked-into" the schedule. You may consult in private with the doctor if a walk-in situation occurs. This does not apply to walk-ins for minor frame repairs, frame adjustments, or dispensing, however, since most clinics do provide these services without appointment.

In the field, you will find that the military eye clinic is a busy place. Many eye clinics have a large patient backlog. Remember, that efficient management of the clinic appointment system coupled with a system of short preliminary visual (screening) exams will greatly reduce the patient backlog. In addition, it will enable the patients having the greatest need to obtain a timely appointment. Active duty personnel have first priority on the number of appointments available each month. Local conditions and policies will determine the priorities for the remaining categories of patients, e.g., Federal employees in eye hazardous jobs (Occupational Vision Program), dependents of active duty, retired military personnel, dependents of retired military personnel, and so forth. Disabled vererans are not authorized examinations through military clinics. They receive examinations and other treatment at Veteran Administration Hospitals (VA).



CLINIC	DR.	DAY	DATE

TIME	NAME OF PATIENT		RANK OR STATUS	TELEPHONE NUMBER	PERSONNEL CATEGORY									
	LAST	FIRST AND M.I.			AF	ARMY	NAVY	RET	DEPENDENT				ALL OTHER	
									WIFE	DAU	SON	OTHER		

SAC FORM SEP 65 1028 **DAILY APPOINTMENT SHEET** SAC - OAFB, Nebraska

Figure 1-17 Sample Logbook Page

PATIENT ACCOUNTING

Since our clinics are manned based on the number of patients that are seen each day, careful accounting is vital to keep our staff at full strength. Even the loss of one patient per day could drastically alter the number of personnel authorized. Each patient's visit must be recorded.

There are three basic types of patient examinations performed that are accounted, the refraction, optometrist visit and technician visit. Any or all of these could be scheduled or by walk-in. Each should be reported.

The refraction is the primary performance of the optometrist. It is this number that has the largest impact on manning. Any lens determining procedure performed by the optometrist should be reported as a refraction.

The optometrist may spend time with a patient, but not do a refraction. This may be recorded as a visit only. However this is rare as most procedures will require some form of lens prescribing or determination and should be listed as a refraction if at all.

The technician's visit consists of scheduled and walk-in screenings and other procedures. A spectacle adjustment is not a reportable visit. However, if some instruction is given in the proper wear and care of the spectacles and have the patient read an eye chart this would constitute an accountable visit provided you record it in the medical records.

The most important factor in reporting any visit or refraction is to remember that a medical record entry must be present. The entry must be complete to show that sufficient tasks were performed to constitue a legitimate count, and a signature of the person who performed the procedures must be present. Also all entries should contain necessary data on the patient, the clinic stamp and date.

The report of patients is broken down by patient category and turned in daily to the resource management department. A letter is also sent in monthly with the total number of spectacles and other corrective devices ordered. This figure is also used to figure the total number of personnel authorized in each clinic.

EXERCISE V-3a

INSTRUCTIONS

Complete the following statements with one or more words.

1. Appointments for the Optometry Clinics are usually made through the ______________________________.

2. When setting up your own appointment log, the minimum information desired is ________________________,

____________, ____________, ____________, ____________, ____________, ____________, ______________________.

3. What must be accomplished before a patient can be legally counted as a visit? ______________________

4. The patient count will be turned in to ________________________ on a ______________________ basis.

INSTRUMENT MAINTENANCE

OBJECTIVE

Given WS J3ABR91235-000-V-3b, identify procedures involved in instrument user maintenance with 80% accuracy.

INTRODUCTION

The maintenance conducted by technicians in the clinic is very minor. In most cases it could be called preventative maintenance. We will discuss only maintenance you can handle at the clinic level. Keep in mind if the maintenance requires the use of tools, then it should be done by medical maintenance.

Dust Covers

Those old, wrinkled and often yellowed plastic bags covering various instruments in your clinic are "dust covers". They have a real purpose. They keep dust off the exterior lenses, chin rests, intricate electrical elements, marking devices, etc. The dust covers should be in place whenever the instrument is not being used. Each night, without fail, each instrument must be covered. This does not preclude daily cleaning of chin rest but the covers will reduce the necessity to clean lenses each day.

Cleaning

As you know cleanliness in our clinics is very important to our image and the patient's health. Alcohol is the primary cleaning agent for all instruments. All lenses on the phoropter lensometer, bowl perimeters, etc. can be cleaned quickly and relatively lint free with cotton swabs and alcohol.

Chin and forehead rests, occluders, etc. can be cleaned quickly with alcohol and cotton sponges or cotton balls.

Light bulbs

Most instruments have a light bulb which burns out when you least expect it. Fortunately the bulbs are easy to get to without the use of special tools.

The B&L vertometer bulb is easy to replace if you follow these steps:

1. Unplug the instrument
2. Crank power wheel in the minus direction as far as you can. This will be the ±20.00D mark.
3. Remove side plate near the rear of the instrument.
4. Turn the bulb tray towards the opening
5. Remove and replace bulb

The AO lensometer is equally as easy to change. Follow these directions:

1. Unplug the instrument
2. Crank power wheel in the minus direction to ±20.00D mark
3. Remove the rear cover
4. Remove and replace bulb

The VTA-ND and the Keystone Telebinocular use the same type of bulb to illuminate the test charts. The replacement procedures for the VTA-ND are as follows:

1. Unplug instrument
2. Unscrew bulb holder for the left hand side of the instrument
3. Remove the ribbed metal light guide from bulb
4. Remove and replace bulb
5. Replace light guide with ribs facing forward toward the test plates. This attachment provides even illumination of test plate and must be positioned properly.
6. Replace bulb holder

The Keystone is much simpler and requires only that you first unplug the instrument and remove and replace the bulb.

The bulb you'll replace the most often is in the projectochart. The task is not any more difficult but it will seem that way when you have to do it. Follow these directions:

1. Unplug instrument
2. Obtain a napkin or cloth because the bult will probably be hot!
3. Open rear of projector
4. Remove bulb reflecting case
5. Using napkin, press down on bulb and turn counterclockwise
6. Replace bulb by pressing down and turning clockwise. If it won't turn try filing a little off the contact points on the bottom of the bulb.
7. After bulb is in place wipe it clean. Removing fingerprints from any bulb will increase its life. The oils from your fingers create hot spots causing it to burn out faster.

There is a little bulb on the NCT which can be changed easily. This bulb is located in the headrest indicator arm. You simply pull the arm apart at the swivel joint and remove and replace burnt out bulb.

The Harrington-Flocks Tachistoscope has a black strobe light located in the front panel. Looking at this panel from the booklet side you'll find it. The bulb is removed by rotating it and sliding it out.

Just remember, if you have to use tools to maintain an instrument then it's a job for medical mainteance.

EXERCISE V-3b

INSTRUCTIONS

Answer each question by filling the blank or circling the best answer.

1. Dust covers need only be in place at the end of the day.
   a. True
   b. False
2. Acetone and cotton swabs are used to clean the lenses on optometry instruments.
   a. True
   b. False

3. To remove the bulb in the projectochart you must ______________________________ and turn the bulb ________________.

4. Why must you wipe fingerprints off new bulbs?

____

____

5. Who maintains our instruments if the repair calls for the use of tools? ____________________

VISUAL SCREENING

OBJECTIVE

Given necessary materials and instructor selected patients perform four (4) visual screenings with no more than three (3) instructor assists per patient.

EENT CLINIC SIMULATED OPTOMETRY CLINIC

Your clinical practicum will last five days, of which at least a total of four days will be spent in the EENT clinic of the Sheppard Regional Hospital or a simulated optometry clinic at the School of Health Care Sciences. During this period you will be asked to perform any and all procedures you have been taught over the last eight weeks. Your instructors have done their best to prepare you for the field and it will be up to you to do those tasks necessary to graduate from this course.

When asked to perform any of the tasks, the procedure will be as follows:

1. Each student will be assigned a minimum of four (4) patients and the eye lane to use.
2. Practice of each task involved in the visual screening will commence.
3. Study the tasks prior to the practicum.
4. During the practicum do the tasks required. There will not be time to "cram" for all the tasks so study before performance day!

The following list includes most of the taks you will be asked to perform. You may wish to check each one as it is satisfactorily completed, or you may use the list to plan your studies for the night prior to performing each task. You will receive credit for completing an item whether you perform it at the hospital or in the simulated clinic, as long as an instructor observes your performance. If you receive a "U" on any item, you must satisfactorily retake that item prior to graduation. Items with "Us" cannot be retaken until all other students have attempted that item.

1. Prepare a DD 741 or SF 600
2. Take a valid case history
3. Measure literate VA (projectochart and near card)
4. Measure illiterate VA (projectochart and near card)
5. Perform pinhole test if necessary
6. Perform plus lens test if necessary
7. Perform cover test
8. Perform diagnostic H
9. Use Prince Rule
10. Perform Worth 4-Dot test
11. Perform Stereofly test
12. Perform Verhoeff Stereopter test
13. Take pupil reflexes
14. Perform VTS-CV
15. Score USAF-CTT
16. Measure peripheral fields
17. Measure central fields
18. Administer Amsler Grid test
19. Administer and record NCT
20. Take and record blood pressure
21. Perform Keystone visual skills
22. Perform VTA-ND
23. Compute spherical equivalents
24. Transpose prescriptions
25. Compute multifocal to single vision Rx
26. Verify ordered prescriptions
27. Measure PD
28. Measure frame size
29. Measure multifocal height
30. Remove and insert lenses
31. Adjust frame to fit patient

Vision Screening Examination

You will do preleminary testing on actual patients in a simulated optometry clinic situation at the School of Health Care Sciences. Always remember to be polite, courteous and congenial and to treat patients the way you would like to be treated if you were a patient. Your instructors will demonstrate the work up procedures and you will be given time to practice on each other before actually seeing patients. You will find the following checklist extremely helpful.

Preliminary testing

1. Case history
2. Lensometer (present glasses)
3. Measure blood pressure
4. VA (habitual)
    a. Distance
    b. Near
5. Pinhole disc test (if indicated)
   Plus lens test (if indicated)
6. Cover test (distance and near)
7. Pupils
8. H-test
9. PD
10. Frame size and multifocal height (when indicated)
11. NCT
12. Worth 4-Dot test (children only)
13. Stereo fly test (children only)
14. VTS-CV

The examples on the following pages (Figures 1-8, 1-9 and 1-10) are actual prelimiary workups which were performed by students in the 91235 course in a simulated clinic situation. The format may change from clinic to clinic depending on the doctor, however, for our purposes here you will be expected to adhere to this format.

Successful completion of the practicum will indicate to your instructors that you are ready to go out to the field and do the job for which you have been training. Remember these simple rules: be courteous to every person who enters the clinic. Always maintain a professional appearance. Finally, be prepared to learn from your doctor and other technicians. Good Luck!

SAMPLE

Standard Form 600
GENERAL SERVICES ADMINISTRATION AND
INTERAGENCY COMMITTEE ON MEDICAL RECORDS
FPMR 101 11.806-8
OCTOBER 1975

OPTOMETRY CLINIC/SHCS
Sheppard AFB, Tx. 76311

HEALTH RECORD	CHRONOLOGICAL RECORD OF MEDICAL CARE
DATE	SYMPTOMS, DIAGNOSIS, TREATMENT, TREATING ORGANIZATION *(Sign each entry)*
9OCT79	22 yo WM. Last exam X 2½ yrs Wears glasses constant. Good Health Pt. taking med for asthma. 2operations for crossed eyes at ages 2+4. Father had crossed eyes also. CC pt. thinks OD may be getting worse Present Rx OD +4.00 D sph OS +1.00 −0.50 X 030 DVAcc OD 20/60 NVAcc OD 20/50 OS 20/20 OS 20/20 OU 20/20 OU 20/20 CT − constant Ⓡ Esotropia dist & near PERRLA EOM's full & unrestricted PD− 68/65 48/22/ 4½ Bifocal Seght OD 17 OS 17 NCT OD 15 OS 16 M Baum MARVIN G. BAUM, Major, USAF, BSC, OD 01430958 3 9256

PATIENT'S IDENTIFICATION *(Use this Space for Mechanical Imprint)*

Figure 1-8

PATIENT'S NAME *(Last, First, Middle initial)* Roberts Thomas P			SEX M
YEAR OF BIRTH	RELATIONSHIP TO SPONSOR Self	COMPONENT/STATUS AD	DEPART/SERVICE DAF
SPONSOR'S NAME —			RANK/GRADE A1C
SSAN OR IDENTIFICATION NO. 216 − 83 − 5273		ORGANIZATION SHCS	

EXCEPTION TO SF 600
APPROVED BY NARS AUG 79

CHRONOLOGICAL RECORD OF MEDICAL CARE
Standard Form 600

SAMPLE

Standard Form 600
GENERAL SERVICES ADMINISTRATION AND
INTERAGENCY COMMITTEE ON MEDICAL RECORDS
FPMR 101 11.806-8
OCTOBER 1975

OPTOMETRY CLINIC/SHCS
Sheppard AFB, Tx. 76311

HEALTH RECORD	CHRONOLOGICAL RECORD OF MEDICAL CARE
DATE	**SYMPTOMS, DIAGNOSIS, TREATMENT, TREATING ORGANIZATION** *(Sign each entry)*
9 OCT 80	4 yo WF Never examined never wore.
	Good health. ō med NMEH. Grandmother
	has cataracts cc Routine exam for pre school.
	DVA sc OD 20/25 OS 20/25 OU 20/25 6' E game NVA sc OD OS OU 20/25
	+ lens passed OU
	C.T. - dist ortho
	near ortho
	PERRLA
	EOM's full + unrestricted
	Worth 4 dot - normal (ortho)
	Stereo test - 100 secs (animals)
	PD 56/54
	NCT OD 13 OS 14
	MARVIN G. BAUM, MAJ, USAF, BSC AFSC 9256, 014-30-9583 SHCS Sheppard AFB, Tx. 76311 9256 014309583

PATIENT'S IDENTIFICATION *(Use this Space for Mechanical Imprint)*

Figure 1-9

PATIENT'S NAME *(Last, First, Middle initial)* Jones Shirley L			SEX F
YEAR OF BIRTH	RELATIONSHIP TO SPONSOR Daughter	COMPONENT/STATUS AD	DEPART/SERVICE AF
SPONSOR'S NAME John			RANK/GRADE TSgt
SSAN OR IDENTIFICATION NO. 368 - 80 - 9222		ORGANIZATION SHCS	

29

EXCEPTION TO SF 600
APPROVED BY NARS AUG 79

CHRONOLOGICAL RECORD OF MEDICAL CARE
Standard Form 600

SAMPLE

Standard Form 600
GENERAL SERVICES ADMINISTRATION AND
INTERAGENCY COMMITTEE ON MEDICAL RECORDS
FPMR 101 11.806-8
OCTOBER 1975

OPTOMETRY CLINIC/SHCS
Sheppard AFB, Tx. 76311

HEALTH RECORD	CHRONOLOGICAL RECORD OF MEDICAL CARE
DATE	**SYMPTOMS, DIAGNOSIS, TREATMENT, TREATING ORGANIZATION** *(Sign each entry)*
9 OCT 80	55 yo WF last exam X 3 yrs. wears mostly
	for reading. pt has diabetes and heart problems.
	pt taking heart med and insulin. NMEH.
	Father went blind because of diabetes.
	CC near vision is blurry lately. Frontal
	headaches after reading at times.
	present Rx OD +0.50 −0.25 X 095
	OS +0.75 − 0.25 X 105
	add +2.00 OU
	DVAcc OD OS OU 20/25 NVAcc OD OS OU 20/30
	C.T. dist ortho near exophoria
	PERRLA
	EOM's – full + unrestricted
	PD 62/59
	NCT OD OS 18

Baum
MARVIN G. BAUM, MAJ, USAF, BSC
AFSC 9256, 014-30-9583
SHCS Sheppard AFB, Tx. 76311
9256 014309583

PATIENT'S IDENTIFICATION *(Use this Space for Mechanical Imprint)*

Figure 1-10

PATIENT'S NAME *(Last, First, Middle initial)* Smith Lucy R			SEX F
YEAR OF BIRTH	RELATIONSHIP TO SPONSOR Wife	COMPONENT/STATUS Ret	DEPART./SERVICE NAVY
SPONSOR'S NAME Martin			RANK/GRADE E-8
SSAN OR IDENTIFICATION NO. 229-86-4237		ORGANIZATION —	

30 EXCEPTION TO SF 600
APPROVED BY NARS AUG 79

CHRONOLOGICAL RECORD OF MEDICAL CARE
Standard Form 600

Congratulations! If you are reading this, you have probably passed the course. Your course supervisor and instructors sincerely wish you the best of success in the 912x5 career field. We hope the course was reasonably enjoyable as well as informative, and invite you to keep in touch with us and each other. One way to do this is to read the quarterly Optometry Newsletter sent each O.D. by the Associate Chief of the B.S.C. (Optometry). Another way is to keep us informed of your whereabouts and problems. Even though you will no longer be in the course, we are available to assist you with any technical problems which may arise - just call AUTOVON 736-6410 or 736-6232.